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ROENTGENOTHERAPY

Fig. 1.

PROFESSOR WILLIAM CONRAD ROENTGEN
The Discoverer of the Roentgen Ray.

ROENTGENOTHERAPY

BY

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WITH 111 ILLUSTRATIONS

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TO MY MOTHER
SARAH JANE TRACY TYLER
THIS VOLUME
IS AFFECTIONATELY DEDICATED

52279

PREFACE

It has seemed to the author that there is a dearth of reliable texts available to the beginner in roentgenotherapy. To fill that want and to give a text in simple terms so that the novice can readily grasp the principles involved is the purpose of this book. A brief description of apparatus needed for roentgenotherapy has been profusely illustrated in order to familiarize the reader with the mechanical and electrical side of the work. Detailed technic for the treatment of different conditions has been given as well as cases cited illustrating each disease. The material in this book has been the result of a scrutiny of the literature and the author's experience during the past ten years. The author wishes to acknowledge his gratefulness to the Fellows of the American Roentgen Ray Society whose inspiration has made this work possible.

A. F. T.

Omaha, Nebr.

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ROENTGENOTHERAPY

CHAPTER I

INTRODUCTION

There have been two epochal inventions in recent years which have contributed their share to roentgenotherapy. We have in mind the invention of the so-called interrupterless transformer by Clyde Snook, of Philadelphia, and the Coolidge tube by Professor W. D. Coolidge, of Schenectady. The former invention has made it possible to deliver large quantities of electrical energy continuously over prolonged periods of time without variation in the voltage. This type of apparatus requires little care, is easily controlled, and is a pleasure to operate.

The invention of the Coolidge tube gave us a tube which is capable of receiving the heavy output of the interrupterless transformer over prolonged periods of time. With the combination of the two instruments massive doses of roentgen ray can be administered at will. Quantities of roentgen ray are now administered which were formerly undreamed of and impossible. This possibility is not only of great potential good but also of great potential danger, for unless the physician using these instruments is well trained, it is like placing a forty-two centimeter gun in the hands of a five year old child.

As is true with all recent discoveries in science, roentgenology has suffered from a lack of uniform terms to describe it. It seemed in the past that every author tried to devise a terminology of his own. This lack of uniformity resulted in much confusion and made comparison of the work of one man with that of another difficult. To aid in unity of expression the American Roentgen Ray Society at its annual session in Boston, 1914, adopted a terminology which has become uniform throughout the United States. The word "Roentgen" is used as a prefix to all the terminal endings in order to give honor to the discoverer of the roentgen ray and to give uniform terminology. The following list gives the principal words with their meaning.

Roentgen: Pronounced rent gen.

Roentgen Ray: A phenomenon in physics discovered by William Conrad Roentgen.

Roentgenology: The study and practice of the roentgen ray as it applies to medicine and surgery.

Roentgenologist: One skilled in roentgenology.

Roentgenogram: The shadow picture produced by the roentgen ray on a sensitized plate or film.

Roentgenograph (verb): To make a roentgenogram.

Roentgenoscope: An apparatus for examination with the fluoroscopic screen excited by the roentgen ray.

Roentgenoscopy: Examination by means of the roentgenoscope.

Roentgenography: The art of making roentgenograms.

Roentgenize: To apply the roentgen ray.

Roentgenization: The application of the roentgen ray.

Roentgenism: Untoward effect of the roentgen ray.

Roentgen Diagnosis: Diagnosis by aid of the roentgen ray.

Roentgenotherapy: Treatment by the application of the roentgen ray.

Roentgen Dermatitis: Skin reaction due to too strong or too often repeated application of the roentgen ray.

CHAPTER II

NECESSARY APPARATUS

Power Plant

On the Continent the induction coil is still used almost exclusively for deep therapy work. In America, however, the coil has been almost entirely replaced by the so-called "interrupterless transformer" which makes use of the alternating current instead of the direct current necessary for a coil. Most of the commercial power plants of American cities furnish the alternating current to

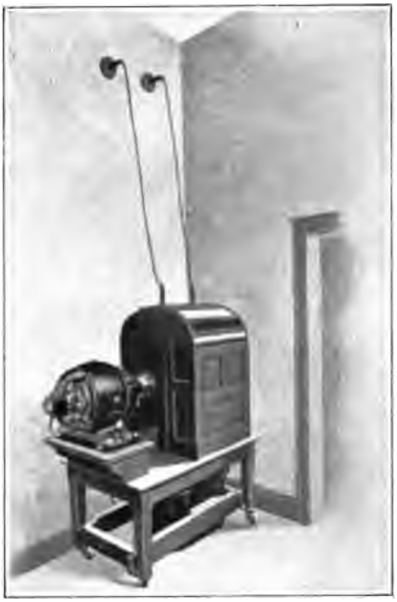

Fig. 2.—Photograph of the first interrupterless transformer. This instrument is still in use at the University of Pennsylvania Hospital, Philadelphia.

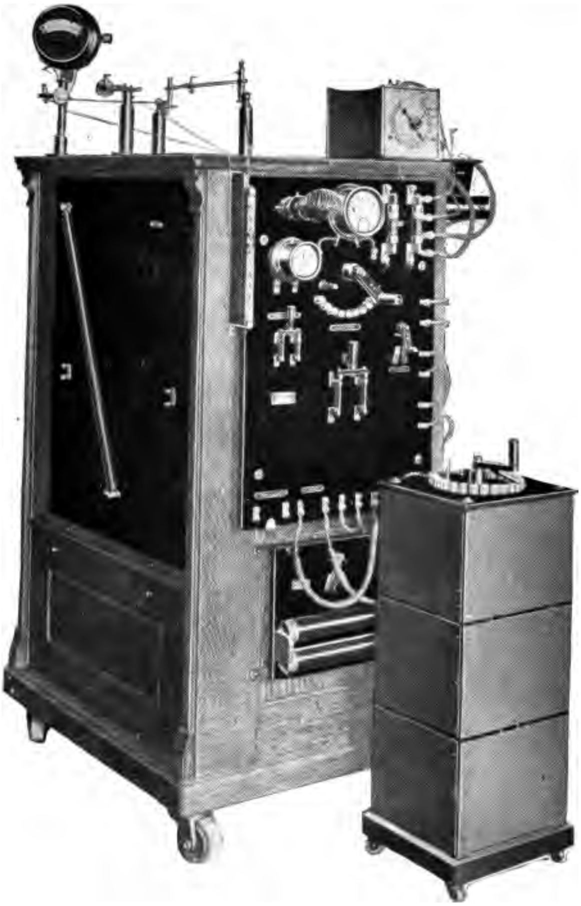

Fig. 3.—Another type of interrupterless transformer which is suitable for deep roentgen therapy.

which the interrupterless transformer is especially adapted. The principle of this type of apparatus is the fact that there is a synchronous motor attached to a large revolving disc. This disc is used to rectify the current so that only the peak of the wave is used. This disc revolves with the synchronous motor and is so timed that the current is cut in when the peak of the wave is reached, this motor running in synchronism with the motor at the city power plant. When one wishes to use the current through the x-ray tube another switch is thrown in which throws the 220 volt alternating current directly into the transformer, the rectifying switch cutting off the peak of the load so that it all flows in one direction as it passes from the transformer to the x-ray tube. This

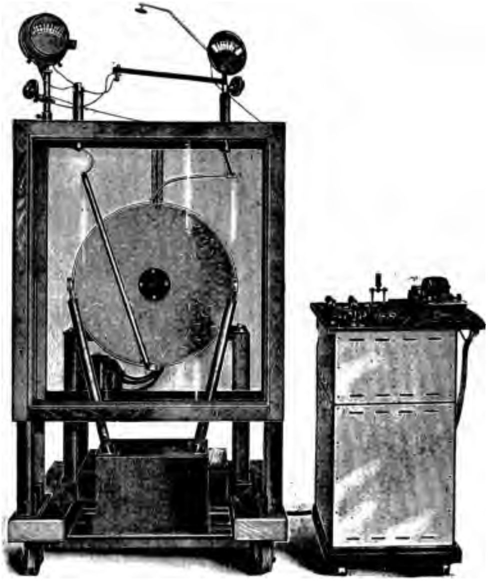

Fig. 4.—A special interrupterless transformer for deep roentgen therapy.

type of apparatus can be used for constant service without any mechanical trouble or overheating. In this respect it has a tremendous advantage over the induction coil. Much more current can be delivered by this type of transformer than the ordinary Coolidge tube will bear. When one chooses this type of transformer for deep therapy he should choose one which will stand constant service, backing up not less than a ten-inch spark gap.

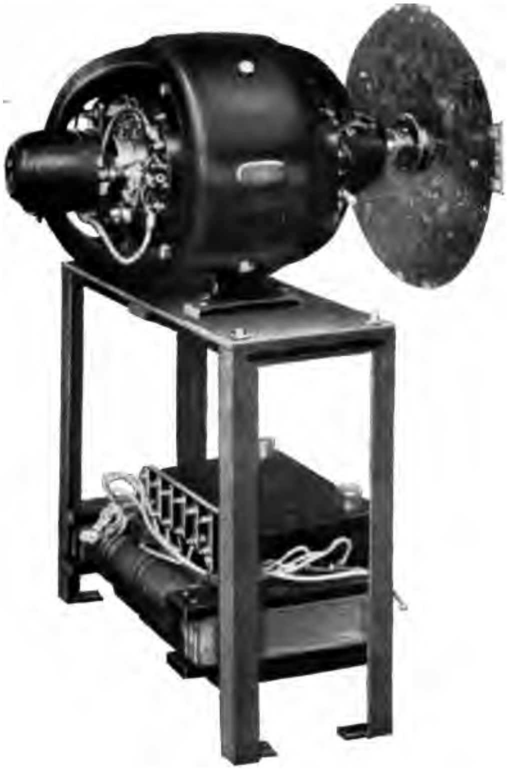

Fig. 5.—Photograph showing the transformer, synchronous motor and rectifying disc of an interrupterless transformer.

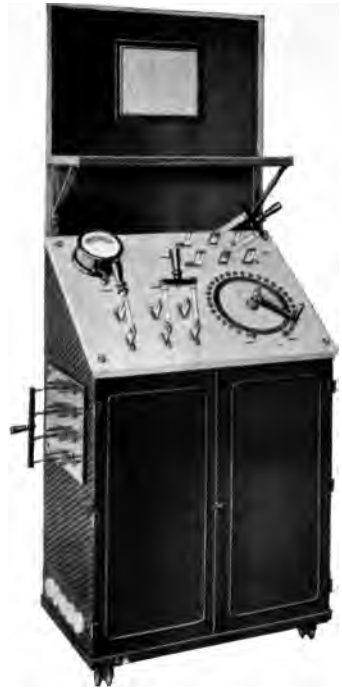

Fig. 6.—Switchboard of one type of interrupterless transformer.

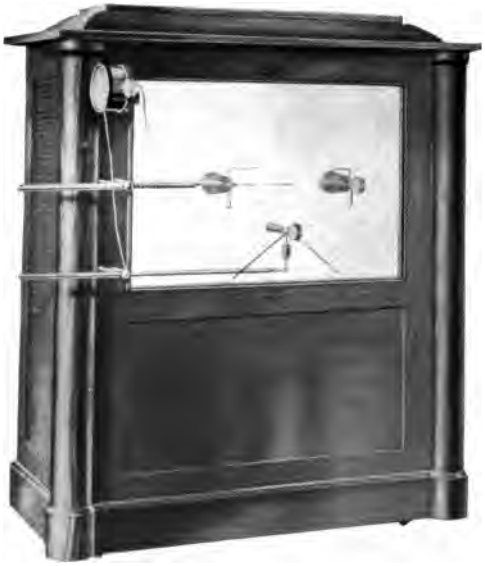

Fig. 7.—Photograph of an interrupterless transformer built especially for deep therapy.

The Coolidge Tube

For deep therapy work it is absolutely essential that one be equipped with a Coolidge tube. The gas tube will not stand heating and the interrupterless transformer does heat the tube to a considerable extent. The Coolidge tube will become hot but will continue to deliver the same quality of rays as when not heated, if one stays within the limit of safety. This limit is reached when the tungsten anode begins to fuse.

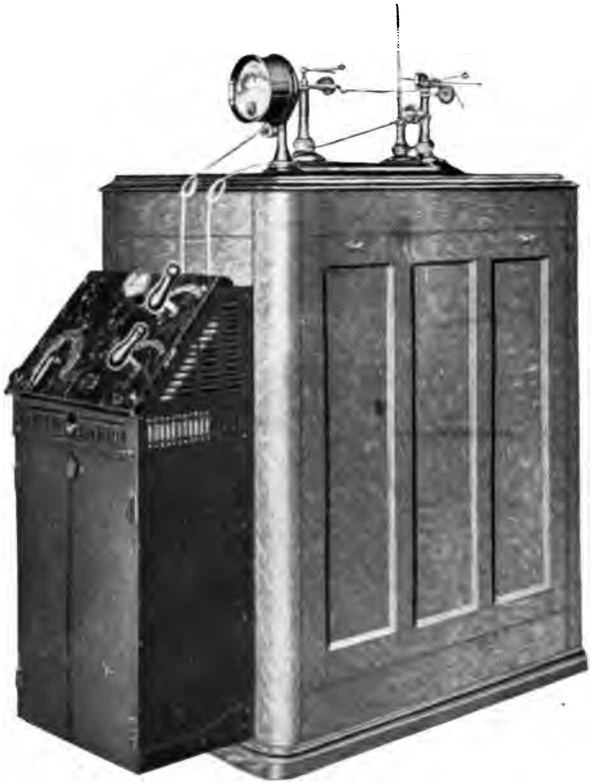

Fig. 8.—Photograph of another type of interrupterless transformer showing the switchboard attached to the end of the cabinet.

The Coolidge tube differs from the ordinary gas tube in several respects. It is an absolute vacuum so far as it is possible to make it so. Not only is all the gas exhausted from the glass bulb, but the gas which is usually contained in the metal parts is also driven out. Because of the fact that the gas has been driven out from the metal parts in the Coolidge tube, the quality of the rays does not change when the metal parts become hot. Because of the fact that the air has been completely exhausted from the tube some method must be used to make it possible to force the electric current through the tube, as electricity will not travel through a vacuum. Coolidge overcame this difficulty by inserting a small tungsten lamp in the cathode stem. When the current is turned on this lamp glows like an ordinary mazda lamp,

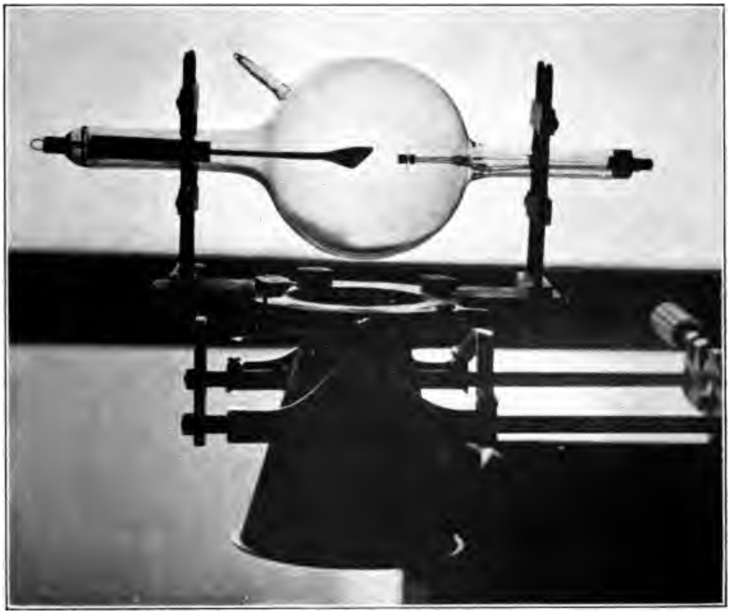

Fig. 9.—Photograph of the Coolidge tube.

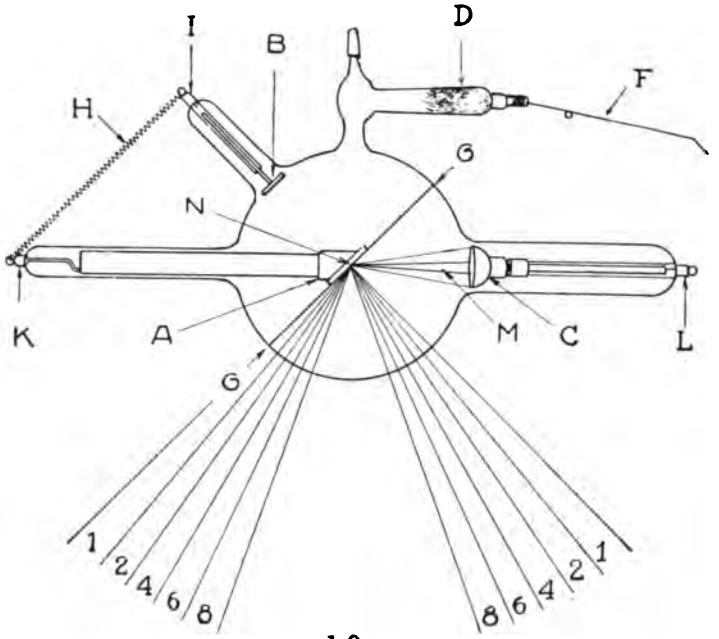

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Fig. 10.—Schematic diagram showing various parts of the ordinary gas x-ray tube. *A*. Anode. *B*. Assistant anode. *C*. Cathode. *D*. Regulating chamber. *F*. Regulating adjuster. *G*. Hemisphere. *H*. Connection between the anode and assistant anode. *I*. Assistant anode cap. *K*. Anode cap. *L*. Cathode cap. *M*. Cathode stream. *N*. Focal point.

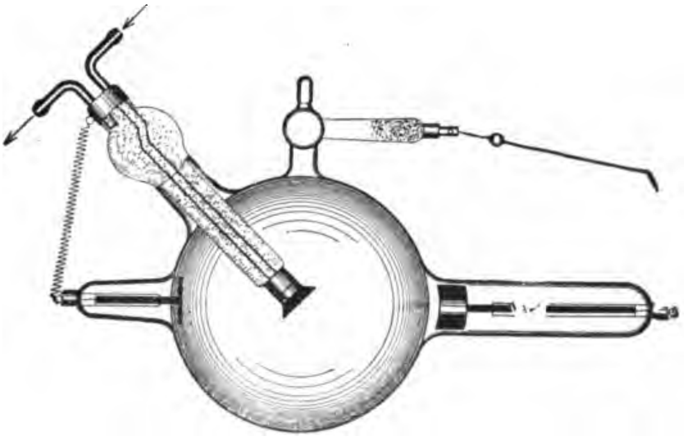

Fig. 11.—Type of water cooled tube used for deep therapy.

the tungsten filament becoming white hot. This white-hot filament gives off electrons upon which the electric current travels from anode to cathode. It is impossible to force current through the Coolidge tube when this incandescent filament is not lighted.

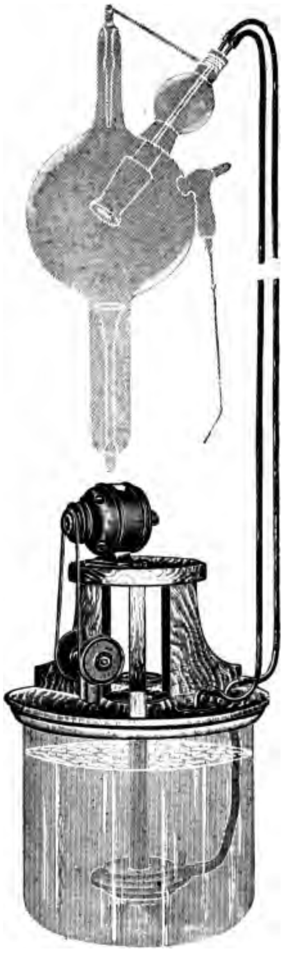

Fig. 12.—Diagram of a pump used in the water cooling system for keeping the anode cool during long periods of treatment where water cooled type of tube is used.

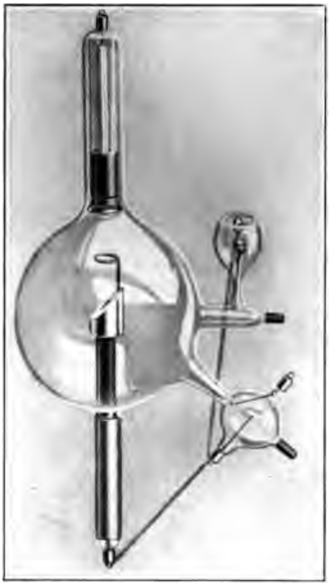

Fig. 13.—Hydrogen tube.

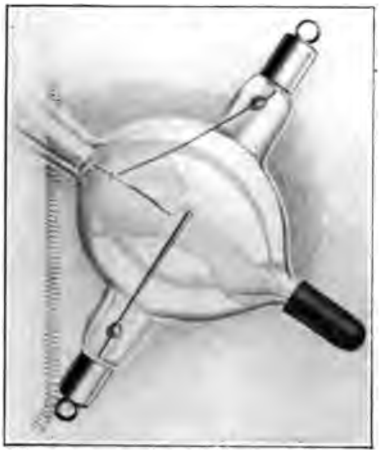

Fig. 14.—The lowering chamber on the hydrogen tube.

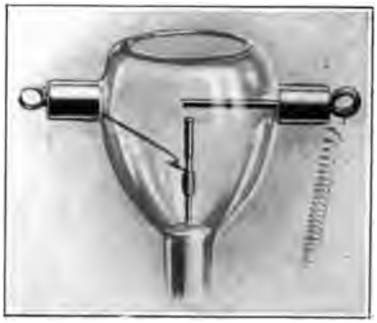

Fig. 15.—The raising chamber on the hydrogen tube.

Coolidge Tube Filament Control

The fact that one must have a small incandescent lamp lighted inside of the Coolidge tube before one can pass current through makes it necessary for one to have some type of current control so that he can regulate the amount of heat in the little filament. The colder this filament is, the less current will pass through the Coolidge tube ~~and the more highly penetrating are the rays which are produced.~~ The hotter this filament, the more current will pass through the tube ~~and less penetrating rays will be produced~~. Many men recommend an ordinary storage battery for lighting this filament. This method is open to objection because of the fact that as the storage battery becomes exhausted there is a difference in the

llacy

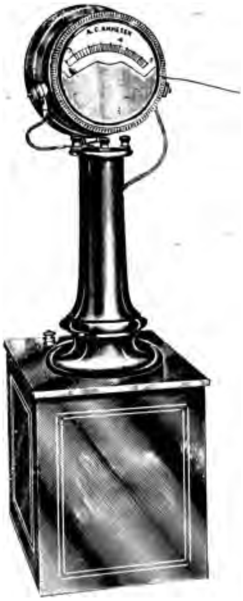

Fig. 16.—Photograph of Coolidge filament step-down transformer for reducing the ordinary lighting current of 110 volts to 12 volts which is used in the filament of the cathode of the Coolidge tube.

amount of current delivered to the filament so that one must constantly calculate on this difference. To overcome this objection, most of the manufacturers have now perfected a small step-down transformer which can be connected directly to the ordinary light circuit of 110 volts alternating current. When this transformer is properly connected to the light circuit it reduces the voltage from 110 to 12 which is the proper voltage for use in the filament. These step-down transformers are so arranged that one can raise or lower the amount of current delivered to the filament by simply turning a button on the side of the instrument which will shift the current in the direction desired. This instrument is a small reostat or resistance coil made of fine wire. The more resistance thrown into the circuit the less current is delivered to the filament in the Coolidge tube. The less resistance in the circuit the more current passes into the filament.

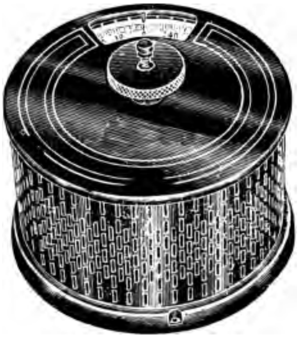

Fig. 17.—Coolidge filament current control.

Tube Stand

For deep therapy one must be equipped with a tube stand which can be easily moved in different positions and which can be tilted in all directions. These require-ments are essential because of the different parts of the body which one wishes to attack with this form of treatment. Not only must the tube stand be good mechanically but it must be equipped with a heavy lead-glass protection bowl. Formerly it was the custom to enclose the

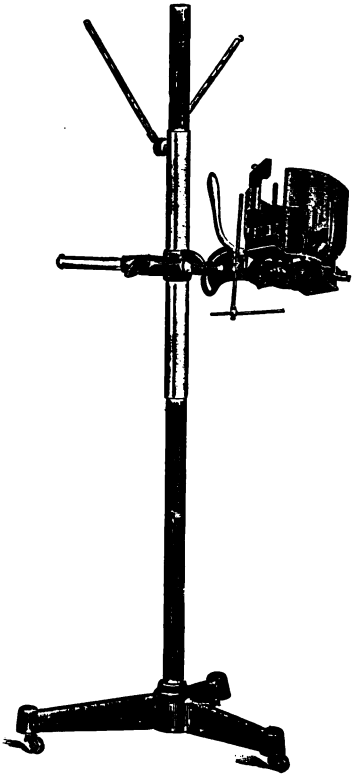

Fig. 18.—One type of treatment stand.

Coolidge tube within a lead-lined box. This is absolutely safe so far as the patient is concerned, but has resulted in puncturing a great many Coolidge tubes. It is difficult to keep the tube clean when enclosed in a box. It is also impossible to see how the tube is behaving. After trying this type of treatment box we have changed to the use of a lead-glass bowl so that the tube is open. Theoretically this method is not safe, but practically we find that it is. We have never yet had a patient who was burned by the use of this kind of a tube holder. The tube stand must have a slot underneath the lead-glass bowl into which the aluminum filters can be slipped. This slot should be wide enough to admit a six millimeter filter. There should also be a place underneath where the sole leather filter can be placed. Various sized cones can be slipped underneath into the bottom of the tube stand so as to cut off all the rays except the part upon which one wishes them to play. The opening in the bottom of the tube stand through which the rays are to pass should preferably be circular. The circular openings are open to criticism because of the fact that it is difficult to keep from overlapping and not all of the skin surface is treated. Where the square opening is used one can hew close to the marks on the skin without overlapping and

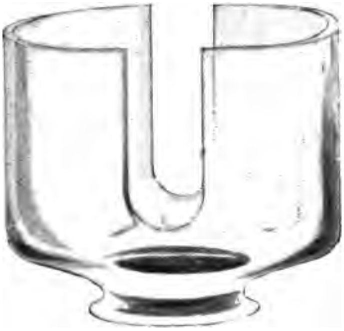

Fig. 19.

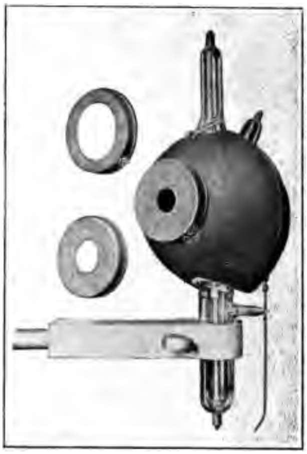

Fig. 20.

Fig. 19.—Lead glass protection bowl.

Fig. 20.—Lead rubber composition protector. This is safe only for the smallest type of apparatus used in superficial work.

can treat all of the skin to the same degree. When the square cone is being used one must be careful to move the cone so that the sides remain parallel to the lines marked on the skin, otherwise there would be an overlapping at one point and a failure to cover at the opposite side of the cone.

The objection made to the circular cone that it leaves a corner untreated can be remedied by using a sheet of ⅛ inch lead on the patient's skin underneath the cone. In the center of this sheet lead is cut a square opening as large as the cone will cover easily. This opening in the lead is placed over the area one wishes to treat while the other areas are thus protected. The circular cone has the advantage that the arm of the tube stand can be swung from side to side and backward and forward across the body without having to move the base of the stand. In a day's work this labor-saving element is worth considering.

On the tube stand above the Coolidge tube should be placed an electric blower which will direct a stream of air immediately downward onto the Coolidge tube. This carries off the heat sufficiently to prevent the glass of the tube from becoming overheated.

Immediately underneath the tube but above the aluminum filter should be inserted a piece of pure glass one-eighth of an inch thick. This will insulate the tube from the metal of the filter. Often the static current generated around the Coolidge tube when used with high voltages will discharge from the side of the bulb to the metal filter unless insulated with glass. This static discharge will frequently puncture the tube. One-eighth inch of pure glass has practically the same filter value as one millimeter of aluminum and must be considered when estimating the amount of filter suitable for a given case.

Treatment Table

The table which is used for the patient who is receiving treatment should preferably be made of wood. This minimizes the danger of the current becoming grounded onto the patient while taking treatment. The table ought not only to be made of wood, but it should have large rollers and these should be fitted with rubber tires. These large rollers make it easy to move the table about even with the patient upon it and the rubber tires add to the insulation. I have found that a table about twenty-four inches wide by six feet four inches long is preferable. This is narrow enough that one can get at any part of the body from the side and is broad enough that it is comfortable for the patient to lie upon. One should make the patient as comfortable as possible while taking the treatment, especially where the treatment extends over a prolonged period of time or where the patient is quite

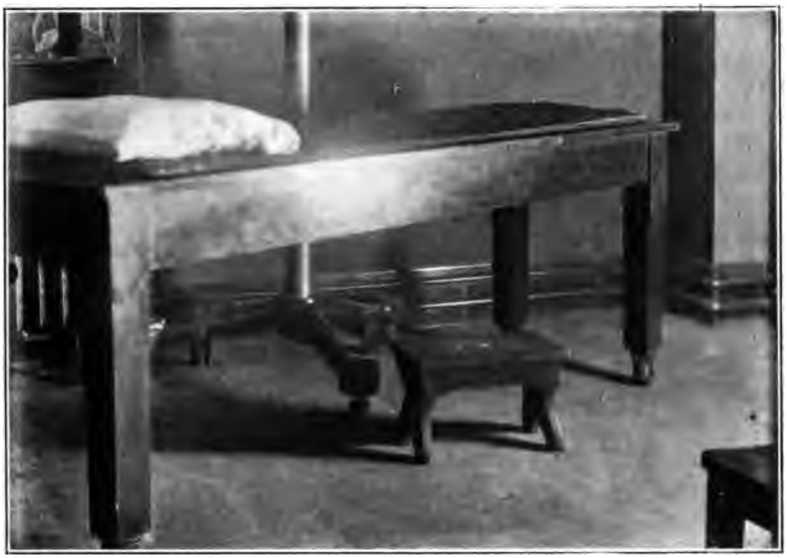

Fig. 21.—Photograph of a wooden table suitable for use in deep therapy.

feeble from his illness. We find it very convenient to have several pillows and several small-sized sand bags handy in order to help place the patient in a comfortable position for different treatments.

Milliamperemeter

There should be a milliamperemeter placed in the circuit between the interrupterless transformer and the Coolidge tube. This is preferably placed in the negative circuit so that it indicates the amount of current delivered to the tube. The milliamperemeter registers as its name implies, thousandths of an ampere. The index reading on this instrument multiplied by the voltage used, gives the quantity of current which is being delivered to the tube. By using this instrument one can establish a definite setting on the transformer switch board which will deliver a given dosage in a given time. After this has been tested out it is only necessary to use the pastilles for measuring the dosage occasionally to check up and see whether conditions are remaining the same.

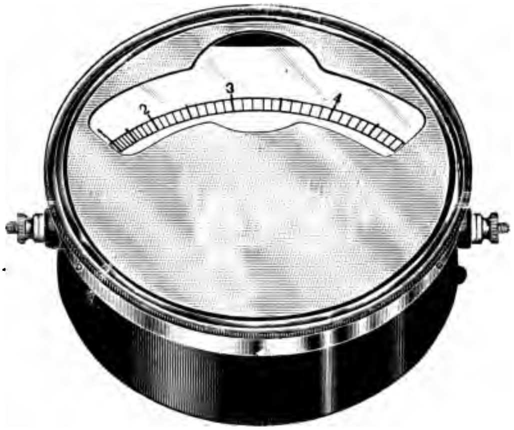

Fig. 22.—Photograph of milliamperemeter for measuring the current passing from the transformer to the Coolidge tube.

Some method of estimating the dosage should always be used. The most universal method is the use of little pastilles which are simply small pieces of cardboard coated with a thin layer of platino-barium-cyanide. This chemical when exposed to the roentgen rays changes in color from an apple green to dark brown, depending upon the amount of exposure. These pastilles are compared with a standard before exposure and then after exposure, the standard indicating a definite amount of dosage. Some type of apparatus of this kind should be in the hands of everyone doing deep therapy.

Filters

One should have in hand three filters, one millimeter, two millimeters, and three millimeters in thickness.

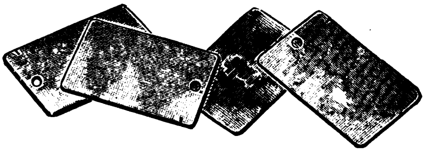

Fig. 23.—Aluminum filters which are used in the treatment stand being interposed between the Coolidge tube and the skin surface.

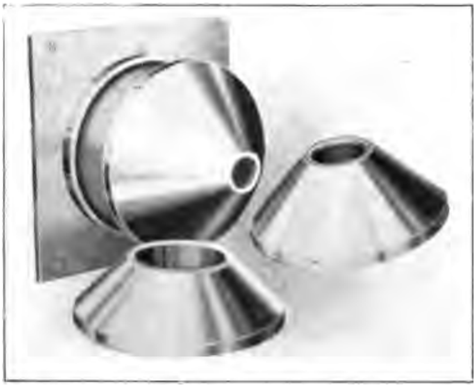

Fig. 24.—Types of cones used underneath the treatment stand. The various sized openings are used for treatment of various sized areas.

These should be made of pure aluminum and should be shaped to fit into the slot on the under surface of the tube stand. In addition to these, one should have a piece of sole leather one-fourth of an inch thick which is to be inserted between the aluminum filters and the patient's skin.

Lead-Rubber Sheeting

One should be provided with sufficient lead-rubber sheeting to cover the entire patient when lying on the table. It is best to have this sheeting in three pieces so that one piece can have a hole near one side through which the treatment is given, the other two pieces being used to cover the remainder of the patient's body. This lead-rubber sheeting protects the distant parts of the patient's body from any stray rays which might come through along the cathode stem of the tube and from all secondary rays generated in the room. The sheeting also

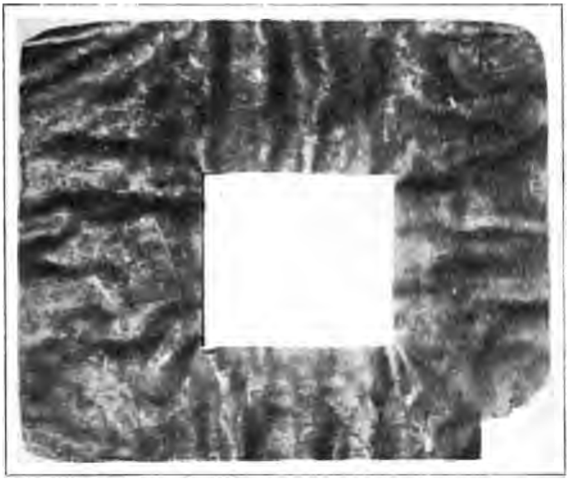

Fig. 25.—Photograph of piece of sheet lead, one-eighth inch thick with a square hole in the center. The areas on the skin are made the same size as the opening in this piece of sheet lead. By using this lead on the skin surface, one can cover the entire surface without danger of overlapping or missing.

keeps the patient from thoughtlessly raising his hands near the high tension wires. Of course the patient is constantly under the eye of the operator during deep therapy treatment. He should never be left alone one second while the high voltage current is turned on.

Arrangement of Apparatus

When one is planning for deep therapy, several factors enter into the arrangement of the apparatus which are not so essential when one is planning for surface work alone. Chief among these factors is the element of protection for the operator. Such large quantities of rays are given off into the room where deep therapy is being administered that I feel that it is absolutely essential that the room itself should be lined with sheet lead not less than one-sixteenth of an inch in thickness. This lead should be placed either in the center of the wall or on the inside so that when one stands outside the room, the wall itself will be between the operator and the sheet of lead. This arrangement is necessary to cut off the secondary rays which are generated in the lead when struck by the roentgen ray. With such an arrangement the transformer, the tube stand and the table can be placed within the lead-lined room while the switch board and all control apparatus can be placed outside the room. A lead glass window in the door which will permit the operator to watch the patient constantly without being in the room, will make the operator safe. It is needless to say that the wires which are to carry the high voltage current from the transformer to the tube and return should be placed well up toward the ceiling and should be spaced far enough apart that there will be no sparking across between them. They should also be placed far enough away from the ceiling or away from any metal such as radiators, electric light fixtures, gas pipes, etc., so there will be no danger of grounding.

The room itself, in which the patient is placed, should be well ventilated. If one is doing only a limited amount of treatment, a window on each side of the room will be sufficient. If considerable treatment work is being given an exhaust fan is absolutely essential. The ozone which is liberated in the room during the use of the high tension currents which are necessary in deep therapy becomes poisonous to the patients and makes them very sick. Not only do the patients suffer from breathing the ozone in the poorly ventilated room, but as these large doses of roentgen rays are administered, a systemic con-

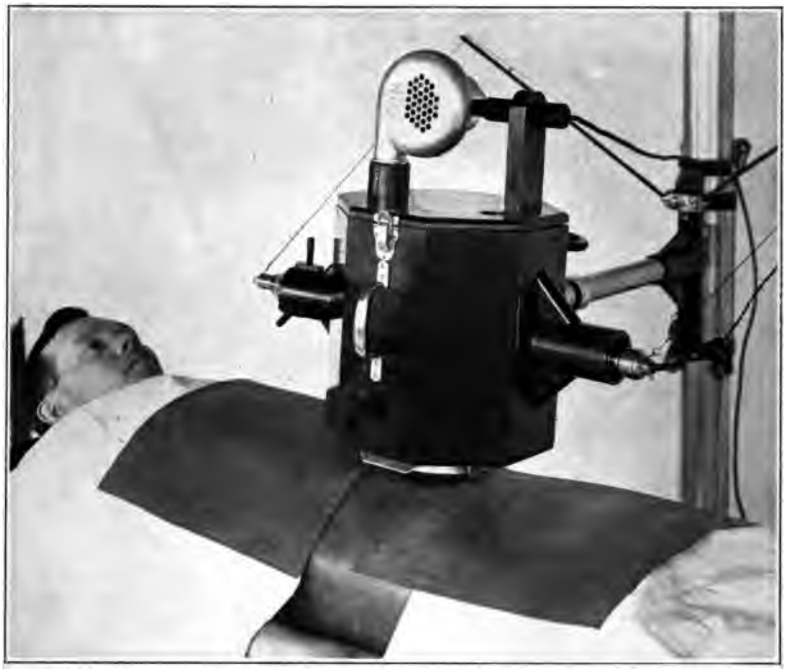

Fig. 26.—Photograph of blower which must be attached to the treatment stand above the Coolidge tube so as to project a constant stream of cool air upon the tube during long exposures which are necessary in deep therapy.

dition is produced resulting in an acidosis. The patient becomes very ill and if the treatment is carried too far he will vomit before leaving the office. Every precaution should be used to prevent this condition.

Sidney Lange, of Cincinnati, several years ago called attention to the production of an acidosis in patients being given large doses of highly penetrating roentgen rays. The production of an acidosis was determined by examining the urine of the patients before treatment was begun then repeating the examinations during the course of treatments. Doctor Lange has advised the administration of twenty grains of soda bicarbonate four times daily beginning forty-eight hours before treatment is begun and continuing through the series of treatments and for several days afterward. In our hands, this method minimizes the nausea but does not entirely prevent it. We feel that several factors enter into the production of the nausea, viz., inhaling ozonized air, the production of an acidosis, toxemia from the detritus thrown into the circulation by the rapid cell destruction resulting from exposure to heavy doses of roentgen ray and direct action of the ray upon nerve centers. Our experience corroborates that of Case and others that patients who are treated in the region of a nerve plexus become much more nauseated than those treated on other

Fig. 27.—Photograph of lead foil for use in covering the patient during deep therapy.

parts of the body. For example, the patients affected most severely are those who have the epigastric region exposed to heavy doses of roentgen ray.

Methods Used in the Estimation of Dosage

In arriving at a satisfactory method of measuring dosage of roentgen rays, considerable painstaking work has been done. The old method where the fractional dosage treatment is used is to give what by experience one has learned to be a safe dosage, repeating this at intervals of a few days after sufficient time has elapsed for a roentgen ray erythema. When this erythema appears, treatment is discontinued until sufficient time has elapsed to see just what has been accomplished by the treatment already administered. This method is still used where this type of treatment is thought to be more satisfactory, namely, in certain skin lesions. Of course, this is far

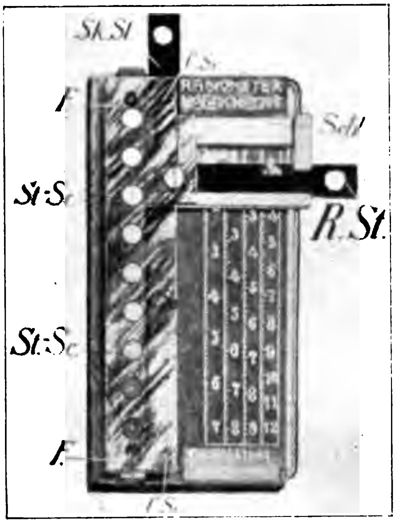

Fig. 28.—Photograph of the Holzknecht radiometer.

from scientific and allows so much of the personal element to enter in that it is difficult for a standard to be established. Where this method is used, it is difficult for one physician to describe to another how much dosage has been given. In order to overcome this difficulty, several thousand exposures were made on the normal skin, a sufficient exposure being given in each instance to make the hair drop out. At the same time that these exposures were being given, small pastilles of barium-platino-cyanide were exposed and the color change noted. After these thousands of exposures had been made, the average color change was taken as a standard and called an epilation dose. It is this standard dose which is used in all of the modern methods of estimating the quantity of roentgen rays administered. These several different methods have been introduced by Holzknecht, Sabou-

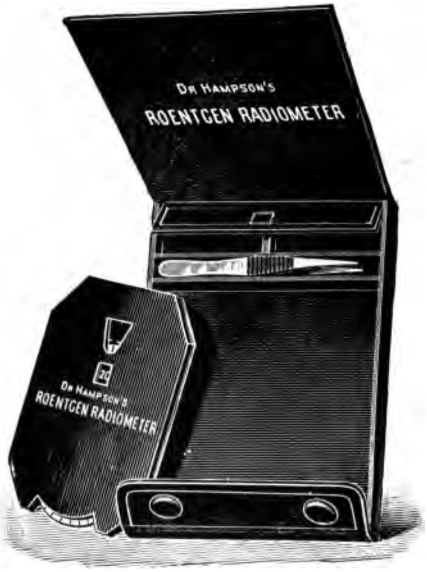

Fig. 29.—Photograph of Hampson's roentgen radiometer.

raud, Kienböck, Hampson and others. The methods devised by all of these men, except Kienböck, are dependent upon the change of color produced in barium-platino-cyanide pastilles by the action of the roentgen ray. Barium-platino-cyanide normally has an apple-green color and when exposed to the roentgen ray changes to a brown. The chief objection to all of these schemes is that there is a chance for misjudging the shade of color.

Kienböck Method.—In order to overcome this objection, Kienböck devised a method of exposing ordinary photographers' paper coated with silver bromide of a certain formula and developing each exposure a certain given time in a solution of given ingredients and then when a certain shade of black had been produced, which corresponded with a certain dose on the other type of instrument, this was taken as a standard. It is much easier to judge changes from white to black than it is from green to brown, and in this respect the Kienböck method is highly advantageous. The details of working it out however, have been found objectionable by many men,

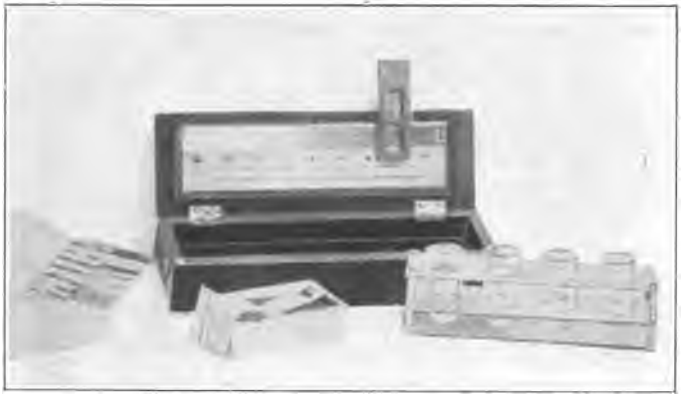

Fig. 30.—Photograph of the Kienböch apparatus for measuring the quantity of rays given off from the roentgen tube.

especially where a large quantity of work is being done. The apparatus consists of:

1. Strips of bromide of silver paper measuring ½ inch by 2½ inches, enclosed in small light-tight envelopes. The envelopes bear a label to be filled up with the name of the patient, date, and duration of the exposure. Envelope and strip bear identical numbers.

2. A standard scale in wooden case, containing eight different tints of the colors which the bromide of silver will assume gradually under prolonged influence of the roentgen ray. A runner with glass window slides along the scale, and the developed strips are placed into this frame.

3. A set of four test tubes of two inches diameter and two inches length, in small metal stands.

A convenient addition, when a dark room is not available, is a dark box, which enables the operator to develop the strips in the consulting room. This box has room for the stand holding the test tubes, in which development, washing, and fixing take place. It is, however, much better to develop the strips in a dark room.

Arrangements for Exposure.—One or several strips of the sensitive paper are placed on the part to be treated; they absorb practically no roentgen rays. The side of the envelope bearing the label must face the patient's skin. If the total dose is to be administered in several sittings, the same strip is always exposed again, so that the sum total of the rays reaching the patient will also reach the strip. If many sittings with short exposures are to be given, it is convenient to use more than one strip; one is left to record the total sum, and of the other, parts are cut off from time to time to make test developments.

The number of the strip, and other remarks, are immediately entered into the case book, where also the strip is stuck when it has been washed and dried.

Development.—In order to find out the quantity of roentgen rays which has been administered, the strip has to be developed.

The developer consists of two stock solutions, A and B, mixed in proper proportions with distilled water, and made up as follows:

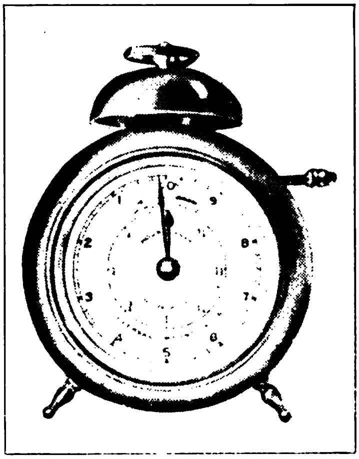

Fig. 31.—Photograph of an automatic timer which should always be used during roentgen therapy. When the treatment is begun the timer is set, when it expires an alarm rings. This prevents any danger of overexposing.

A		B	
Distilled water,	1000 c.c.	Distilled water,	1000 c.c.
Sulphite of soda,	150 gm.	Potassium carbonate,	150 gm.
Metol (Hauff),	15 gm.		

Fixing Solution

Distilled water,	1000 c.c.
Sulphite of soda,	20 gm.
Tartaric acid,	10 "
Hyposulphite,	200 "

Great care must be taken in preparing the solutions; it is essential that the bottles shall be absolutely clean, and that distilled water shall be used throughout. The developer should never be used when it has become stale.

An alternative developer consists of a stock solution, made up as follows:

Metol,	1 gm.
Hydroquinone,	4 "
Sodii sulphite,	50 "
Carbonate,	50 "
10 per cent solution of potassium bromide,	4 c.c.
Distilled water,	500 "

The fixing solution is made up as follows:

Hypo,	400 gm.
Water,	1000 c.c.
Potassium meta-bisulphite,	25 gm.

Each box of strips is furnished with a set of instructions regarding the duration of development, and these must be carefully observed.

It is not always possible to make succeeding batches of strips of exactly the same degree of sensitiveness; therefore each new batch is carefully tested, and if necessary a new scale of tints is prepared. Each strip is marked with a letter and must only be compared with a scale bearing the same letter.

The first of the four test tubes is filled with the developer mentioned above, the second is filled with water, the third with fixing solution, and the fourth with water. The strips are taken out of the envelope either in the dark room or in the dark box mentioned above, and are immersed in the developer for a certain time, as stated on the instructions with the strips. The strip must be kept in motion while in the developer. The same developer can be used for several strips, but it deteriorates gradually in contact with air. As in photography, great care must be taken that the developer is not contaminated with hypo, and it must be at the temperature stated on the instructions (18° C.), because too cold a developer produces far too light a tint. After development, the strip is washed for a few seconds in the second glass, and transferred into the third glass containing the fixing solution. It ought to remain in this not less than a minute, but if it remains longer no harm is done. Then it is rinsed in the fourth glass, and is ready for comparison with the standard scale. (It need not be dry for this purpose.) To leave a permanent record, the strip has to be washed like any print for about half an hour in several changes of water. Several strips may be developed or fixed simultaneously by using a large vessel.

The standard scale consists of nine different tints, marked 0, ½, 1, 2, 3, 4, 5, 6, 7, 10. The tint marked 1 is to be considered the unit, and is denoted by 1 x. It is half the value of the dose required to produce one unit in the Holzknecht chromoradiometer, and one tenth of the Sabouraud-Noiré Tint B. dose.

We therefore have:

10 × (Kienböck) = 5 H (Holzknecht) =
1 B (Sabouraud-Noiré).

If it is intended to administer the maximum dose in one sitting, it will be a convenience to expose two strips of paper simultaneously. When, measuring the current passing through the tubes with a suitable milliamperemeter or judging the degree of fluorescence by experience, it is found that the maximum dose desired has been nearly reached, the exposure is interrupted for a few minutes to develop one strip and compare it with the standard scale. If it took ten minutes to produce tint No. 5, then it will require another two minutes to bring it to tint No. 6, or if it took nine minutes to impart to the strip the color of tint No. 6, it will take another six minutes' exposure to bring it to a color similar to tint No. 10 (provided that the condition of the tube has not altered materially).

As it is not possible to read the value of the dose directly from the quantimeter strip during the irradiation, it is advisable to measure the dose at the same time by observing the milliamperemeter, and timing the duration with a watch, or it may be checked by using at the half-distance a Sabouraud or a Hampson or Lovibond radiometer.

If it is desired to ascertain the quantity of roentgen rays which have reached a certain depth, a piece of aluminum 1 mm. thick is laid on part of the strip. It has been found that this absorbs as much of the roentgen rays as a layer 1 cm. thick of skin, fat and muscle will absorb. In such a case, the developed strip will show two different tints: the darker one indicates the quantity of rays received by the surface of the skin; the lighter tint records the quantity of rays which have penetrated to a depth of 1 cm. below the skin. Strips of aluminum are supplied also which help to find the effect produced at 1, 2 or 3 cm. depth. If the effect is desired on the skin only, it is advisable to use medium tubes, No. 8 Wehnelt; if deeper lying parts have to be treated, it is necessary to take tubes No. 10 or 11 Wehnelt. It is an advantage to bring the tubes rather close to the skin (distance 8 to 18 cm.); for treating ringworm, 15 cm.; for treating ovaries, 18 to 25 cm.

It is, however, often necessary nowadays to give doses far larger than 10 x in a single sitting for the treatment of fibroids or malignant disease. As the strips would become far too dark for comparative readings to be made under these circumstances, a second scale has been prepared, in which tints are shown which are obtained on strips exposed under a block of aluminum 10 mm. thick. In this way the action on the strip is lessened and the latter does not become so dark, although large doses are given. Quantities up to 30 or 40 x can be conveniently estimated. The comparison, development, etc., of the strips is exactly the same as if the 10 mm. aluminum were not used. The dose which the strip then shows is that which has been applied at the surface, and not, as is sometimes assumed, that which has reached 10 cm. depth. The strips should be compared with the standard scale and a record kept of all exposures given, with the total dose for each complete treatment. The method of recording these data will vary with each operation. A record sheet should be reserved for each patient and all particulars of treatment entered on it. A portion of the developed paper may be arranged opposite each dose, and its numerical value placed alongside. This enables the operator to calculate rapidly the total of the exposures. All the other data of exposure should also be recorded.

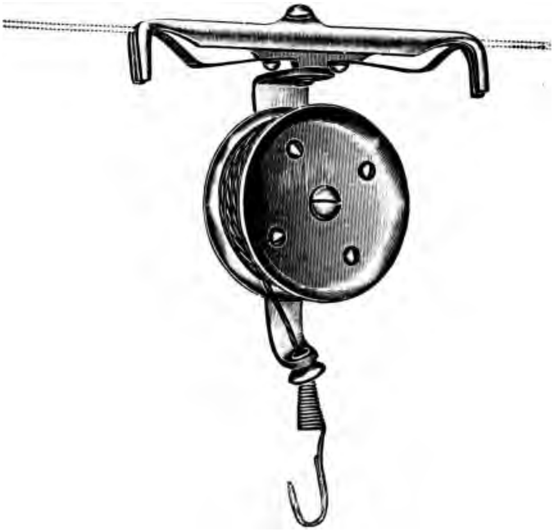

Fig. 32.—Cord reel for conducting the current from the overhead wires to the anode terminal of the Coolidge tube.

Holzknecht's Quantimeter

For this instrument barium-platino-cyanide pastilles are used. Those which have been exposed to the roentgen ray are compared with a set of unexposed pastilles which are covered with a celluloid film of reddish brown color which gradually increases in density up to that which has been found to mark the change when an erythema dose is given. Since the present war has come upon us, it has been impossible to get supplies of these German-made quantimeters, so that we have come to rely upon British quantimeters, called Hampson's radiometer.

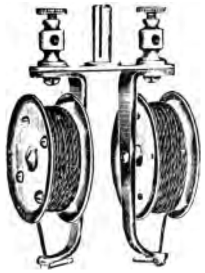

Fig. 33.—Double cord reel for conducting the current from the cathode terminal of the Coolidge tube to the overhead wires and for conducting the current to the small filament in the cathode of the Coolidge tube.

Hampson's Radiometer

The instrument devised by Hampson consists of a series of twenty-five carefully graded tints which represent the color assumed by a pastille of barium-platino-cyanide when exposed to different quantities of roentgen rays. The initial or zero tint is the color of an unexposed pastille and the sixteenth change represents the browner shade of color equivalent to the maximum of brown of the pastille used by Sabouraud. The radiometer consists of these tints arranged on a circular card outside of which is a slot in which to place the pastille which has been exposed. This case has an aperture through which the tints can be viewed, one at a time. The slot is so arranged that the exposed pastille in the aperture can be placed in close proximity with the tint card, the card being rotated by the thumb until an exact match in color has been obtained. Another small opening exposes to view a series of numbers, ranging from naught to twenty-four, whereby the tint can be identified. The whole is covered with black cloth so that there may be no outside attraction to distract from very sensitive color perception. The tints on the standard in this instrument are so arranged that they should always be viewed by artificial light. One should be careful to employ for this an incandescent carbon filament lamp, instead of the commonly used mazda tungsten filament lamp. The pastille which is being used to measure the dosage is placed in a lightproof envelope and laid upon the patient's skin, underneath all of the filters. When this pastille has been exposed to a sufficient quantity of roentgen rays to make it change four divisions of the standard scale furnished with the instrument, then an epilation dose has been administered to the patient's skin. As these barium-platino-cyanide pastilles change color and deteriorate when kept in a dry hot room, they should be kept where the air is cool and moist. One of the best methods of preserving them is to suspend them over a little water in a glass jar.

CHAPTER III

SUPERFICIAL THERAPY

A great many authors in discussing roentgenotherapy take up the different diseases and describe in detail the technic required for treating each disease. After following this method for a considerable period of time, it has appeared to the author to be simpler to classify the diseases according to the technic required in their treatment rather than according to the etiology of the individual disease. If we classify them in this manner, we will find that certain diseases, especially those of the skin, both benign and malignant, will require about a certain technic, while certain other skin diseases, and all of the tissues which are treated below the surface of the body, will require a different technic. The superficial technic may briefly be described as follows:

The setting for the machine is made so that it will back up a five-inch spark gap and one millimeter of aluminum and leather filter is used. The milliamperemeter should register two milliamperes, the treatment lasting three minutes. The anode-skin distance should be eight inches. Ten such treatments will produce a pronounced erythema. A cone of the proper size to cover the part which one wishes to treat is inserted underneath the tube so as to cut off the rays from the surrounding tissue which is not to be exposed. If the surface to be treated is larger than can be covered at a single exposure, through a given sized cone, it is better to mark off the surface into areas, each one a proper size for the cone which will be used. In this way the whole surface can be given a measured dosage which in most cases is found to be that which produces a mild erythema.

There are arguments for giving the so-called divided dose, and there are other arguments in favor of the so-called massive dose method. The divided dose method is an inheritance handed down from the earlier days of roentgen therapy, when less powerful apparatus was used. This divided dose method is given so that, as a rule, about ten different treatments are required to produce an erythema. If the treatments are given at sufficient intervals, of course one can keep the patient under observation until the erythema appears, which is the signal to stop treatment. On account of this fact a great many men, especially the dermatologists, prefer this method of treatment. In fact, it gives one a closer personal touch and a finer gradation of dosage. Although it may not be so scientific as the massive dose method, it has its advantages.

The massive dose method has been used and has been brought into vogue since more powerful apparatus has been in use, and is based on the theory that a given dosage will give a definite result. The dosage in this method is accurately measured, usually by some sort of pastille, which changes color when exposed to the roentgen ray and which is compared with a standard color scale coming with the apparatus.

After the physician has examined the patient, he decides what dosage will be required to bring about destruction of the disease and this dosage is administered at one sitting. Of course, this method is a great time-saver and has other advantages, but there are some disadvantages to this method of treatment. It is not always possible for one to estimate accurately just how much dosage is required to produce a given result because of an idiosyncrasy which some people show in response to the roentgen ray as compared with others.

This method also allows the patient to leave the personal observation of the man giving the treatment, and one must depend largely on the opinion of those less experienced in the reactions produced by the roentgen ray, having the patient return usually about every three or four weeks for personal observation.

Types of Diseases Suitable for Superficial Therapy

1. Eczema.
2. Psoriasis.
3. Tuberculosis.
4. Lupus vulgaris.
5. Lupus erythematosus.
6. Acne vulgaris.
7. Ringworm.
8. Papillomata.
9. Ulcers.
10. Prurigo.
11. Lichen.
12. Folliculitis Barbæ.
13. Hyperidrosis.
14. Epitheliomata.
15. Leukoplakia.

Eczema

The acute forms of eczema are not suitable for roentgen treatment. The chronic cases which have passed beyond the weeping stage are those which are especially suited to this form of treatment, and as a rule they respond beautifully.

The patient presents himself with a reddened area covered with coarse scales and oftentimes the area is marked with cracks, and is markedly irritated and painful. In the majority of cases, these patches have had all kinds of medical treatment without results. If one will give sufficient roentgen ray treatments to produce a strong erythema, these patches will be relieved within a very short time.

If the broken dose method of treatment is used, it will require about ten different treatments given every other day. If the massive dose method is used, it will usually require two or possibly three doses, depending upon the reaction of the individual patient and the length of time which the disease has existed. After the erythema has subsided, the skin in this area will be soft and pliable as it was before the disease existed. No scarring will remain and the condition will disappear entirely.

Psoriasis

Psoriasis responds to an erythema dose of roentgen ray in most cases. It may return, however, at another time and require re-treatment. One can here choose either the broken dose method or the massive dose method, in either case carrying the treatment until an erythema is produced.

An interesting thing in the treatment of psoriasis is the fact that very often when the condition exists on different parts of the body, if one area is treated before the other areas are treated the areas on the parts of the body which have not been exposed to the ray will disappear at the same time that those exposed to the rays disappear. This result is probably due to the systemic action of the roentgen ray.

Tuberculosis of the Skin

Tuberculosis of the skin is more obstinate than either of the diseases just mentioned, so that it will often be required to carry the treatment almost to the ulceration stage. On this account, in my experience, the heavy dose method has been the more satisfactory, producing quicker and more definite results. The treatments, however, should be given, and the patient kept under close observation, as oftentimes the wound will need careful dressing. In my experience, a moist alkaline dressing has proved more satisfactory than the ointments. As this disease penetrates into the deeper structures of the skin, the more extensive treatment by the roentgen ray is necessary in order to bring about destruction of the more deeply located disease.

DODD'S FORMULA

Zinc oxide,	½ ounce.
Glycerin,	1 dram.
Carbolic acid,	½ dram.
Lime water, q.s.,	8 ounces.

Lupus Vulgaris

These patients come with the characteristic apple-jelly spots scattered through the skin, the skin itself being reddened and ulcerated, but the disease responds very quickly to proper roentgen ray treatment.

The broken dose method has proved very satisfactory because of the fact that this disease is usually located on the face and one wants to destroy the disease with the minimal amount of scarring. The broken dose method has the advantage of giving one closer observation of the action produced, but even where this method is used, one must carry the treatment far enough to produce destruction of the disease. A filter of one millimeter of aluminum and leather should be used. A spark gap of seven inches is used with five milliamperes of current for five minutes. Two treatments will produce an erythema.

The Finsen light (ultra-violet passed through quartz window) has been extensively used on the Continent but the roentgen ray will do all the Finsen light will do and much quicker. It is easier to apply and has a wider range of usefulness.

Lupus Erythematosus

This condition requires very careful treatment and also requires that the patient remain under close observation for a considerable period of time, not only during the treatment itself but for some time afterward. I lay emphasis upon this fact because of the tendency which this disease has to spring up anew just outside of the area which was diseased at the first observation. One must carry this treatment until a marked erythema is produced, and even in some cases until actual ulceration has been brought about. One must feel his way in treating this disease and watch the effect, because if one produces an actual ulceration, it is bound to leave scars and as it is usually located on the face, the patient does not want this result. If, however, after giving the treatment, the patient has been watched and the result has not been what one expected, then we believe one is justified in going further. Of course, satisfactory explanation must be made to the patient so that one has his consent beforehand. The same technic is employed that is used with lupus vulgaris.

Acne Vulgaris

In addition to the usual medical treatment which is used for this condition, the roentgen ray has been highly beneficial, especially in those indurated cases which do not respond to the usual methods of treatment and where the condition covers a large area of the skin, like one finds oftentimes in young men who have the whole face and a large part of the back involved. Roentgen ray not only helps to eliminate the infection, which is found in these cases, but also softens up the induration which is left in the skin by the scars incident to the inflammatory process produced by repeated ulcerations. One must be very careful, however, in administering the treatment to these cases in order to avoid scarring. On this account, the broken dose method of treatment is preferable, feeling one's way along until an erythema is produced and then resting until the erythema has passed off, to see just how much has been gained and then repeating until the desired result is obtained. The same technic is employed as is used in eczema.

Ringworm

This condition has been treated in the Orient in large numbers, extending over the time since 1904. In America, however, the roentgen ray method of treatment of this condition has not been so universal. However, at the present time, it is considered the most satisfactory method of treating this intractable disease.

The method of treatment is as follows: The hair must be clipped close to the skin, then the scalp is marked off into areas in such a manner that the rays can be applied over the different areas perpendicular to the scalp. Treatment must be carried on until epilation is produced. When this result has been obtained, the hair will fall out and the disease will gradually heal, and after it has healed the hair will grow again, leaving the scalp in a clean, healthy condition. One should use a 9½-inch spark gap, five millimeters of aluminum and leather filter, and five milliamperes current, ten minutes over each area until the entire scalp has been covered. Epilation begins in about ten days and is complete in two to three weeks. The hair will usually return in about three months. Of course the scalp must be kept clean until all signs of disease have disappeared.

Papillomata

Papillomata respond to roentgen ray treatment and one should administer an erythema dose over each growth. The surrounding skin should be protected by lead foil so as not to produce an erythema of the healthy skin. On this account, many patients and physicians prefer some other form of treatment, the roentgen ray treatment being rather tedious.

Personally, we prefer the use of the fulguration treatment as one can absolutely limit the effect as he wishes. There is little pain in its application; one treatment is usually sufficient and the patient can go on about his work. If there is any question of malignancy existing, the fulguration treatment is not sufficient but must be followed by the roentgen ray.

Ulcers of the Skin

Roentgen ray treatment is especially adapted to chronic ulcers of the skin which have become sluggish and indurated and fail to dermatize. These should be treated surgically, so far as cleansing them and keeping them in a sanitary condition is concerned. This treatment should be continued during the roentgen ray treatment. The roentgenization should be continued until the ulcers show irritation and the surrounding skin for about half an inch, in all directions, shows an erythema. When this amount of treatment has been given, the ulcer will begin to look healthy, fresh granulations appear, and new skin will begin to form around the margin. Use the same technic as for eczema. Only nonirritating alkaline moist dressings should be used during roentgen treatment.

Prurigo

Some cases of prurigo respond readily to roentgen therapy. The technic employed should be the same as that used for eczema.

Lichen

Chronic cases will usually respond to treatment administered according to the same technic as used in treating eczema.

Folliculitis Barbæ

This condition will respond to proper roentgen therapy. A full erythema dose of the filtered ray should be given at a single sitting. This will produce erythema and epilation after which the disease will heal. Later, the hair will grow again, usually in about three months. All medicinal applications to the part should be discontinued during the period of treatment and its consequent effect. Use four millimeters aluminum filter and sole leather.

Hyperidrosis

Some patients are troubled with this condition, especially in the axillæ. When one wishes to expose them they should be placed upon the table, lying a little on one side, with the side to be treated upward. The arm should be elevated above the head so as to give easy access to the axillary region. This area should be exposed to the roentgen ray until tanning of the skin is produced and the hair begins to fall out. When this amount of treatment has been given, the sweating will usually diminish and as the skin becomes more leathery the condition entirely ceases. Use the same technic as for ringworm, penetrating rays with the heaviest filter.

Epithelioma

When one speaks of treatment of malignancy with the roentgen ray, we always feel that one should be bold even to the point of giving too much. There is a tendency when treating malignancy with the roentgen ray to stop too soon. Healing occurs so kindly that one often quits before the small nests of cells located in the deeper parts of the skin are killed. Of course, if these have not been killed, at some future time they will begin to grow and will cause a recurrence of the original disease. This is not only disappointing to the patient and to the physician, but casts discredit upon this form of treatment. I feel in treating this kind of disease that one should be just as bold as the surgeon and try to reach all of the tissue involved, and even some of the normal tissue in the neighborhood, in order to be certain. I feel, on this account, that one should not stop the treatment of epithelioma when a mild erythema has been produced, but ought to carry it to the point of ulceration. Not only should the growth itself be exposed, but the surrounding tissue for a considerable distance, depending upon the size of the growth, should also be exposed. It is a good practice also to make a habit of exposing the adjacent lymphatics. These, however, should not be treated by the same technic as that used for the epithelioma. These should be treated by the technic which is described for use in deep-seated conditions. I mean by this that the hard rays should be used in treating the lymphatics, while the softer rays should be used for treating the growth itself. One should carry the treatment of the growth to the point of ulceration; should allow healing to take place; and then should follow with several series of treatments with filtration according to deep technic, using the hard rays in order to be sure that all the cells in the neighborhood have been destroyed. Epithelioma involving the mucous surface is thought, by most men, to require surgical removal first, this to be followed by roentgen treatment. However, we have seen, in many instances, just as satisfactory results following roentgen treatments of this type of epithelioma as we have seen following excision. The tendency in treating epithelioma involving the mucous membrane is to stop too soon, and it is cases treated in this manner which recur and give arguments to the men who say that they should all be excised. I do not wish to minimize the importance of surgical treatment of these growths; in fact, I feel that the roentgenologist should work hand in hand with the surgeon, and if the surgical treatment is adapted to a case, the patient should be immediately referred to a surgeon for treatment with the recommendation that roentgen ray treatment be given after operation. The battle against malignancy deserves all of the best mettle in us so that the patient should have every help possible.

Leukoplakia

I am speaking of leukoplakia at this time because I feel that a combination of the soft and the hard rays is best adapted to the treatment.

It is usually located in the mouth, on the gums, cheek or palate, or sometimes on the side of the tongue. The hard rays are effective, but it has been my experience that where a heavy dosage of soft rays is given, in addition to the hard rays, a quicker and better result is obtained. That is, an erythema dose of the soft rays should be given through the open mouth, while the hard rays can be used not only through the open mouth but also from outside through the cheek, from both sides, if necessary. The lymphatic glands underneath the floor of the mouth should also be exposed to the harder rays to the point of tolerance.

This disease is one of the most resistant forms of malignancy. It should be recognized early and treated vigorously. Because there is often a syphilitic taint in these patients, one should have a Wassermann test made, and if syphilis is present, should institute antisyphilitic treatment while the roentgen ray treatment is going on. There has been a tendency by many physicians to treat this condition as though it were entirely syphilitic. It has never been our good fortune to see one of these cases which responded entirely to antisyphilitic treatment. Those cases which have been treated on this basis have always proved to be malignant and have usually been diagnosed at such a late stage that little help could be given.

CHAPTER IV

DEEP THERAPY

The type of roentgen treatment called "deep therapy" is so called because of the fact that one wishes to reach the deeper tissues and because the rays used for this type of treatment have deep penetrating power. Since the advent of the Coolidge tube, it is possible to deliver to a patient an amount of rays which before that time was absolutely impossible. The Coolidge tube will deliver the same quality of rays hour after hour even though the metal parts become red hot so that one can give a prolonged treatment resulting in a massive dose which is impossible with the ordinary gas tube which changes in vacuum as soon as the metal parts become heated, due to the liberation of the gas from the metals.

The invention of the Coolidge tube threw greater stress upon the transformers which were being used so that a change in the type of machine was made necessary, but now the types which are in general use are adapted to this kind of work and will deliver all or more than the ordinary Coolidge tube will carry. At the present time, the Coolidge tube which is usually sold to physicians is limited to a ten-inch spark gap or about one hundred thousand volts. For treating diseases which are situated beneath the surface it is my observation that one should never use less than a nine-inch spark gap. Because of the change in the physics of the tube when a lower voltage is used, the rays produced are not sufficiently penetrating to give the desired result, so that for all kinds of deep-seated growths and certain superficial growths, which have been mentioned, one should use the maximum load which the Coolidge tube will carry. It is my custom to use not less than 9½-inch and my preference is 9¾-inch parallel spark gap. One should also strive to work with the anode of the tube as close to the skin surface as possible. Most of the tube stands which are recommended for deep therapy make it impossible for one to bring the anode closer than eight inches. If one works at an eight-inch distance, it is necessary to give more time than it would be if one were working at a six-inch distance, for the quantity of the roentgen rays decreases inversely as the square of the distance. This is a definite physical law which no one can change, but which must be used in calculating the amount of the dosage received at any given distance. Several men have devised a tube stand of their own which allows one to work closer than eight inches, and at the present time a Coolidge tube is on the market which is much smaller in diameter than the standard type of tube, but because of the fact that the glass is brought so close to the metal parts in the small sized tubes, a great deal of heat is given off to the glass and the danger of breaking is greatly increased. The focal spot in these small Coolidge tubes is much smaller than in the standard tube so that they are not suited to prolonged use of a high voltage current like one uses in deep therapy. Although the small tube is highly satisfactory for some other forms of roentgen ray work, I feel that the standard tube with a broad focal spot is better adapted to treatment, giving a little longer time to compensate for the increased distance.

The histologic action of roentgen rays on the tissues may be briefly described as follows:

1. It produces an edema of the endothelial lining of the blood vessels. This edema becomes pronounced so that the small arteries become occluded by it, thus shut-

ting off nutrition to the growth. When the treatment is carried far enough this edema results in an endarteritis obliterans in the small capillaries.

2. The second action is on the cells of the growth themselves. The roentgen ray produces a cloudiness of the nucleus followed by disappearance of the nuclear membrane and later by cloudiness and disappearance of the entire cell, the debris being carried away by the phagocytes. After these cells have been destroyed, they are replaced by connective tissue.

When treating deep-seated growths, one must see that sufficient dosage is administered to the growth to produce just as much change in the tissues as one would think necessary if the growth were on the surface where it could be seen. In order to be able to do this a certain form of technic has been devised by Kroenig and Gauss of Freiburg, Germany. This scheme is simply the division of the skin surface into a large number of areas so that one can focus through each area onto the growth, administering an erythema dose to the skin through each area, but giving a definite dosage to the growth. For illustration, if one wished to attack a growth in the abdomen and was able to divide the skin above it into about six areas, he could give an erythema dose through each area, the rays being directed so as to focus upon the growth itself. Because of the fact, however, that the soft tissues interposing between the growth and the skin act as a filter stopping certain rays and because of the fact that the quantity of rays administered to the growth varies inversely as the square of the distance from the tube, it will be seen that in order to produce an erythema dose a few inches beneath the skin, one must give a total of several times an erythema dose through the skin. This is made possible by dividing the adjacent skin into several areas and giving an erythema dose through each area, the rays of all areas being focused at the growth as the center point.

Aside from the malignant growths there are several types of benign growth which are best treated by this technic. Among them are:

1. Hypertrichosis.
2. Angiomata.
3. Portwine stains.
4. Keloids.
5. Tuberculous glands.
6. Hyperthyroidism.
7. Uterine fibroids.
8. Uterine hemorrhage at the menopause without demonstrable pathology.
9. Hodgkin's disease.
10. Splenomyelogenous leukemia.
11. Splenomegaly.

Malignant Growths:

1. Sarcomata.
2. Epitheliomata.
3. Carcinomata.
4. Leukoplakia.

Hypertrichosis

In my opinion it is only justifiable to treat hypertrichosis with the roentgen ray when the superfluous hair covers a large area and the patient is willing to take the risk attendant upon this form of treatment which may result in telangectasis. I seldom advise this treatment for hypertrichosis on the face, but in case a young woman comes in with heavy hair all over the forearms, I think one can use the roentgen ray because any other method would require months and months of time to cover such an extensive area. One must use not less than four millimeters of aluminum and sole leather as a filter and give a mild dose, repeated at intervals of about three weeks so that one can watch the result very closely in order not to give an overdose and produce scarring. Even where this technic is followed, there have been some cases reported in the literature where several months after the treatment had been administered a thrombosis occurred in some of the vessels from the inflammation of their intima due to the action of the roentgen ray, resulting in serious consequences.

Angiomata

There are a good many methods used for the treatment of angiomata. In selected cases, however, nothing gives more beautiful results and more certain action than the roentgen ray. The action in these cases is largely due to the effect upon the vessels themselves. The treatment must be carried on until an endarteritis obliterans has been produced. Of course the heaviest filters, not less than four millimeters of aluminum and leather, are used, the dosage being given until the desired change is produced.

Portwine Stains

Of all the skin lesions that are presented to a physician for correction and treatment, portwine stain is the most difficult. Roentgen ray combined with other methods, where indicated, produces the best results; but when one undertakes the treatment of this condition one must expect to spend hours and hours of time, extending over months, in order to get the desired result and must be prepared when he is through to fall far short of the ideal. These conditions, when presented to the physician, are usually marks on the face so that the cosmetic effect must be as nearly perfect as possible. The hardest quality of rays must be used in order to bring about an endarteritis obliterans in the vessels which have become dilated and even some destruction of the tissue may be necessary in order to get rid of all of the color. Where the tissue is destroyed there will necessarily be some scarring. The patient must be made aware of this before the treatment is undertaken and must assume the responsibility. The same technic is employed as in treating vascular angiomata.

Keloids

Keloids are an overgrowth of scar tissue resulting in an elevation and increase in width and sensitiveness of a scar following some wound in the skin. Certain persons are prone to develop these conditions. The colored race has them frequently. Before the advent of the roentgen ray, no treatment was found satisfactory. After they were excised, they simply reformed in the scar which was left. Since the roentgen ray has come into common use, one can definitely promise to remove them, leaving instead of the keloid a soft pliable scar. The roentgen treatment will not remove the scar, but will leave it in a normal condition.

The treatment must cover a considerable period of time and the patient must be under close observation. One must use not less than four millimeters of aluminum and sole leather interposed between the tube and the skin. The treatment must be given up to a measured erythema dose then sufficient time must be allowed for the results to become manifest when the treatment can be repeated until the desired result is obtained. Keloids which are highly sensitive will lose their sensitiveness in a short time and will gradually soften down, leaving a normal scar which is level with the skin and pliable. The entire treatment will probably cover about three months.

Tuberculous Glands

Enlarged tuberculous glands are most often found in the cervical region, usually in children, sometimes in adults. In adults the customary method is to remove them surgically. In children, nowadays, the rule is to treat them surgically only where suppuration is found when they present themselves. The roentgen ray has proved itself so satisfactory in treating these conditions in children that it is now recommended universally. A recent report of one thousand cases of tuberculous adenitis in the cervical region in children was made and in not one of these cases was pulmonary tuberculosis a sequela. These cases were taken from children's hospitals in New York City and represented all kinds and conditions of the disease, in all nationalities, and were not selected but were taken at random from the hospital records. (Wang, S. L.: Occurrence in Clinical Tuberculosis of Scars from Tuberculosis of Cervical Lymph Nodes, June 30, 1917, Jour. Am. Med. Assn., lxviii, 1963.) With this report confronting us we can not feel but that the roentgen treatment is preferable. No anesthetic is necessary, no hospital stay, no confinement of any kind, and no scar is left afterwards. One must use at least four millimeters of aluminum and sole leather and in many cases six millimeters of aluminum and sole leather are better. An erythema dose should be given at one sitting then the patient should rest three weeks when another erythema dose can be given. This can be repeated until the desired result is obtained. Early cases will respond to one or two treatments.

Where the glands are large and of long standing, the heavier filter is more suited, as one can give a larger dose without danger of skin reaction. In cases which have suppurated and have been drained without removal of the glands, the roentgen treatment will cause the sinus to close and the inflammatory tissue to become soft and pliable and the swollen glands to disappear.

Hyperthyroidism

The results from surgical treatment of this condition have not always proved satisfactory so that since the ability to produce a more highly penetrating ray in large quantities, this condition has been subjected to more frequent roentgen treatment. For years this condition has been treated by roentgen therapy, but in recent years the treatment has become more satisfactory and has become more widespread. If the patient is in an advanced stage of the disease I feel that he should be in the hospital during the treatment, should be kept in bed, and should have the advantage of medical treatment at the same time. This class of patients should be brought to the roentgen laboratory on a cart and should be treated without allowing them to exert themselves. More mild cases can be about and can be treated at the office. It is remarkable how many patients will come in with the characteristic symptoms of this disease, complaining of lassitude and aching pains throughout the body from the toxemia they are undergoing, and after a very few treatments the feeling of lassitude and the aching in the muscles will disappear and the patient will begin to feel more like himself and the pulse will rapidly drop toward normal.

The severity of this condition demands pushing the treatment as rapidly as possible. For that reason the patient should be given a full erythema dose at the first sitting, allowing him to rest three weeks before further treatment is given. The erythema should not be carried to the point of bleb formation or ulceration, as this will leave marked scars, but the skin over the thyroid region and down over the thymus region should be treated until it is tanned dark in color and is leathery in appearance. The tumor will never disappear entirely under this treatment because the gland tissue will be replaced by connective tissue, so if a cosmetic result is sought some other method will have to be adopted. There is, of course, a small percentage of these patients which will not respond to roentgen therapy. If they do not respond so that improvement is noticed after the first treatment, I feel that one should not go further but should recommend some other method of treatment. Of course, there are patients in which surgery is absolutely contraindicated and the roentgen method will have to be given in spite of slow response. The best technic is 9¾-inch spark gap, five millimeters of aluminum and sole leather, five milliamperes of current for ten minutes at eight-inch distance. Give one dose over each lobe and one over the thymus region. Repeat three times at monthly intervals.

Uterine Fibroids

Fibroid tumors of the uterus which produce bleeding about the climacteric are essentially carcinoma, unless proved otherwise, so that one should not treat these cases until carcinoma has been ruled out, preferably by curettement and microscopic examination of the scrapings.

Pedunculated ulcerated fibroids are not suitable for roentgen treatment, neither are the submucous fibroids. Those which are suitable for roentgen treatment are the intramural and subperitoneal type. Calcareous fibroids or those which are undergoing malignant degeneration should not be treated by this method. The subperitoneal and intramural types can be treated with great satisfaction. The hemorrhages can be stopped within a very short time and the tumor itself will disappear almost entirely, in all cases disappearing until it is barely palpable. The treatment should be performed by using the six millimeter filter of aluminum and sole leather. The skin of the abdomen should be divided into several areas covering the abdomen from the navel to the pubes. The corresponding area on the back should also be divided into several areas. A small cone, covering each area should be used, the rays being focused on the tumor. An erythema dose is given through each area. If sufficient dosage has been given, as a rule, the second menstrual period will never appear. Oftentimes, if the treatment is given some time before the expected menstrual period, the time for the first menstrual period will pass without the usual flow and often the flow will not appear at all. The patient will gain in weight, will lose her anemia and will improve very rapidly. If a fibroid does not respond to roentgen treatment it should be considered malignant and surgical treatment advised. This form of treatment for uterine fibroid is highly satisfactory to the patient because it does not necessitate the risk of operation, the unpleasantness of an anesthetic, a stay in the hospital, and the prolonged period of convalescence.

Uterine Hemorrhage at the Menopause Without Demonstrable Pathology

Many women at the climacteric present themselves to the physician complaining of marked menorrhagia, scarcely recovering from one menstrual period before another comes. Examination is often negative, the uterus being of normal size and consistency. Even upon curettement no pathology is found. This class of cases can be promised 100 per cent cures under proper roentgen therapy. The same technic should be employed as in treating fibroid tumors of the uterus. In practically every case, one series of treatments will be sufficient; occasionally a second series will be necessary one month later. Menstruation will cease entirely and will not return. The patient thus passes through the menopause quickly and comfortably.

Hodgkin's Disease

Hodgkin's disease has presented a problem to the medical profession which has been largely unsolved. The most satisfactory method of treatment, however, is the roentgen ray. By proper use of the ray, taking the patients early in the disease, life can be prolonged for a long period of time, they can be made much more comfortable and in some cases actual cures result extending over several years of time. It is remarkable how rapidly these patients respond to roentgen treatment when given in massive doses, using not less than a four-millimeter filter and sole leather. Patients who come in with mediastinal glands so swollen that they are compelled to sit up at night on account of the pressure dyspnea, after a few treatments are able to lie down and sleep in comfort. In a short time the glands situated near the surface will entirely disappear and those in the mediastinum will also diminish in size but not quite so rapidly as those which are more easily attacked. One must keep these patients under close observation and even after all the glands have disappeared, so far as it is possible to determine, one should see that the patient has a series of treatments about once in six months. One should not be content to treat only the affected glands but should make it a routine to treat all areas where masses of lymphatic glands are normally found, viz., the axillæ, inguinal, iliac, and cervical regions, as well as the mediastinum.

Arthur F. Holding, of New York, recently reported a series of ninety-six cases of Hodgkin's disease treated by the roentgen ray. There was pronounced improvement in all these patients, some of them remaining symptomatically well as long as four to six years. All cases have a tendency to spring up into the active stage after a certain period of time. But when one has impressed the patient with the importance of close observation, the disease can be controlled a second or even a third time. Eventually, however, in the large percentage of cases, a stage is reached where no treatment is of any help and the patient rapidly succumbs. Any agent that will hold this disease in check for from one to six years is worthy of use. The roentgen ray is the best agent known at the present time.

Splenomyelogenous Leukemia

Splenomyelogenous leukemia responds remarkably well to roentgen therapy. We should not neglect the usual medical means, however, but should use the roentgen ray in combination with the approved medical treatment. One must constantly check the effects of the roentgen treatment by the blood count. If one is too vigorous in the roentgen treatment the patient will be overcome by the toxemia and will succumb, so we should watch this closely, giving a preliminary series of treatment and waiting to see just what the change has been, making frequent blood counts to determine the result. As soon as the individual patient's response has been determined then one can proceed with the treatment, reducing the blood count as rapidly as is safe for this individual patient.

There will come a time, however, in all of these cases when they will fail to respond not only to the medical treatment, but also to the roentgen treatments and will die in spite of whatever is done. One can relieve them greatly, can prolong their lives several months or years, depending on the severity of the case when first seen, and the treatment is well worth while. One should use not less than a four-millimeter filter and sole leather. One should treat not only the region of the spleen but the long bones. The surgical removal of the spleen is sometimes employed after the patient has improved and the size of the spleen has been reduced sufficiently by roentgen therapy.

Splenomegaly

Splenomegaly responds to roentgen treatment. The effects of the treatment should be checked, however, by frequent blood examinations, and medical treatment should be followed at the same time. Some recommend removal of the spleen in this condition, but since the advent of deep roentgen therapy the results by this method are equally satisfactory and result in a much smaller percentage of mortality. Not less than the four-millimeter filter and sole leather should be used, the plan being to treat from in front, from behind and from the side. Frequent blood counts should be made to determine the amount of reaction produced by the treatment.

CHAPTER V

THE MALIGNANT GROWTHS

Sarcoma

It is my feeling that all forms of malignancy which are operable should be operated first, then followed by roentgen therapy. Sarcoma of the soft tissues responds very rapidly to roentgen therapy and in a majority of cases the results are much more satisfactory than in carcinoma. The effect of the roentgen ray on the blood vessels helps to starve the sarcoma to death, while the effect on the cells produces an actual destruction of the cells and replaces them by scar tissue. By means of roentgen therapy it is possible to treat sarcoma of the antrum of Highmore so as to avoid the necessity of surgical removal of the superior maxilla with its consequent deformity.

The percentage of recurrences by roentgen therapy is no greater than by surgical removal and there is no mortality rate, at the time the treatment is given, all the deaths which follow being due to recurrences or metastasis.

The growth which is near the surface is usually attacked by using the hard penetrating rays through not less than a four-millimeter filter of aluminum and sole leather. The treatment should be made vigorous so as to get quick action and minimize the danger of metastasis.

It will scarcely ever be necessary to produce ulceration of the skin in these cases. The patient should be kept under observation for at least one year, a series of treatments being given after apparent cure once every three months during the first year and the patient reporting for observation once every six months thereafter. Periosteal sarcoma is always a surgical disease and will not respond to roentgen therapy. Myelogenous sarcoma is always fatal no matter what treatment is employed.

Carcinoma

Patients who have been operated upon for the removal of carcinoma should have the advantage of roentgen treatment afterwards, so as to minimize the danger of recurrence. Postoperative roentgen treatment can be commenced as soon as the wound is sufficiently healed to bear it. This type of treatment should cover not only the neighborhood adjacent to the scar but should also cover a large area of that part of the body. If it is for malignancy in the breast it is my routine to treat not only the affected side but to treat the whole chest from the diaphragm up to the base of the skull. These patients should have a series of treatments once every month until three series have been given and then once every three months for one year. Inoperable carcinoma should have the benefit of roentgenotherapy. It is surprising how some of the most hopeless cases will respond when the treatment is judiciously given. Patients who come into the office very weak from the cachexia and anemia following uterine hemorrhage due to carcinoma, will lose the anemia, will begin to gain in weight and will feel almost as they did before they had the disease. This is especially true in carcinoma recurring in the vaginal vault after hysterectomy. These patients may go on and die, but their life will be prolonged, the hemorrhage will seldom, if ever, recur and they will die without pain. By what other means can this result be obtained? Inoperable carcinoma located in other parts of the body may not result in such easy death. This is especially true in large carcinomata about the neck. It has been my experience that these are very resistant to treatment and must be handled with the utmost vigor, even disregarding the effect of the rays on the skin. In this type of disease we must use not less than a four-millimeter filter with sole leather.

Carcinoma of the stomach is thought to be little affected by roentgen treatment, although it has been my privilege to see one patient with a scirrhous carcinoma of the stomach improve materially. She had had a gastroenterostomy to relieve the pyloric obstruction, then the growth had encroached upon the new stoma. She was very thin and the mass was distinctly palpable. Roentgen treatment caused a diminution of one-half in the size of the mass, relieving the obstruction to the new stoma sufficiently to allow free passage of food and consequent relief from vomiting. The patient gained weight and strength, but died in six months with pyloric obstruction and obstruction of the new stoma and malignant cachexia. The relief given these patients by roentgen therapy is so keenly appreciated by them that they beg for more treatment. They die from the cachexia, but with little or no pain. This is in strong contrast to the average death from untreated gastric carcinoma.

Leukoplakia

Leukoplakia has been touched upon in the chapter entitled Superficial Therapy, but deserves further comment at this point. The man who depends upon soft rays only in the treatment of this disease will be sorely disappointed. The most vigorous treatment with the hardest possible rays is the only thing that will touch it. One must disregard all rules of dosage and continue till he sees results. In a recent case, involving the whole lower jaw including the bone, eight successive daily treatments of five minutes each were given over three areas, one on the left cheek, one on the right cheek, and one over the point of the chin. Five millimeters of aluminum and sole leather were used as filters. It was astonishing with what rapidity the growth melted away. In two weeks, there was no evidence of the growth having been present.

It would seem then that success in roentgen therapy is dependent upon several factors which must be closely adhered to in order to prevent failure. One of these factors is the use of heavy filtration. In all deep therapy work it is my belief that not less than four millimeters of aluminum and sole leather should be used and my personal preference is for six millimeters of aluminum and sole leather. In fact, it is my routine to use the heaviest filtration. By doing so, one is able to get an enormous dosage through the skin without vesication, producing instead simply a tanning of the skin. Of course it requires a heavy voltage current used constantly to produce the effect through this much filtration. During the entire time that the machine is in operation, I see that the current is just spitting across a 9¾-inch spark gap. I am very particular about this matter because if this is not done, I do not get the full amount of dosage.

Another factor which I consider essential is the maximum dosage. Of course I measure this by the use of the pastilles, employing the Hampson radiometer, but I do not stop when the pastilles register an erythema dose. On the contrary, I record this dosage on my record, but continue repeating the erythema dose over each area treated until I see the actual erythema showing on the skin. I plan to give an erythema dose as recorded by the pastilles each day until the erythema shows on the skin. This means that I have really given over each area, from eight to twelve times the erythema dose as recorded by the pastilles. This produces an intense skin reaction, but it is my experience that this reaction recedes quickly and acts similar to the skin reaction produced by heavy treatments with radium. On this account, I believe that the action of the roentgen ray filtered through six millimeters of aluminum and sole leather is similar in its action to the radium. The erythema recedes just as nicely as it does following the radium treatment.

The therapeutic results are also comparable to the action of radium. I feel that this difference in dosage and filtration is responsible for the reports of many men as to the difference of action in roentgen ray and radium. This is especially noticeable in writers from the Continent where instead of using the Coolidge tube as used in America, they are still using, in many cases, the gas tube. It is impossible to get this dosage with any form of gas tube which has yet been devised.

CHAPTER VI

CASE HISTORIES

Case No. 6023

Mr. H. I. P., sixteen years old. During the past two years he has had acne vulgaris on both sides of the face.

Results.—He has had four treatments by the fractional dose method resulting in a vivid erythema. The skin is now smooth and pliable and the acne gone.

Case No. 7084

Mr. E. E., twenty years old. For two years he has had severe acne over the face and neck and back. He has been taking vaccines, catharsis, and massage. There is much improvement but yet much induration.

Diagnosis.—Acne vulgaris.

Results.—He is well four months after one treatment.

Case No. 5792

Mr. H. S. For two years he has had scaly patches on the right leg. Two areas are the size of the palm of the hand. Several areas are the size of a ten cent piece.

Diagnosis.—Psoriasis.

Results.—He is entirely well after one year, the fractional dose method of treatment being employed.

Case No. 1956

Mrs. E. C. G., sixty-one years old. She had her right breast removed forty months ago. The left foot has had chronic eczema on the dorsum for three years.

Results.—She has had four treatments on the dorsum of the left foot by the fractional dose method resulting in a vivid erythema. The eczema has entirely disappeared, leaving the skin soft and pliable for the first time in more than three years. (Fig. 34.)

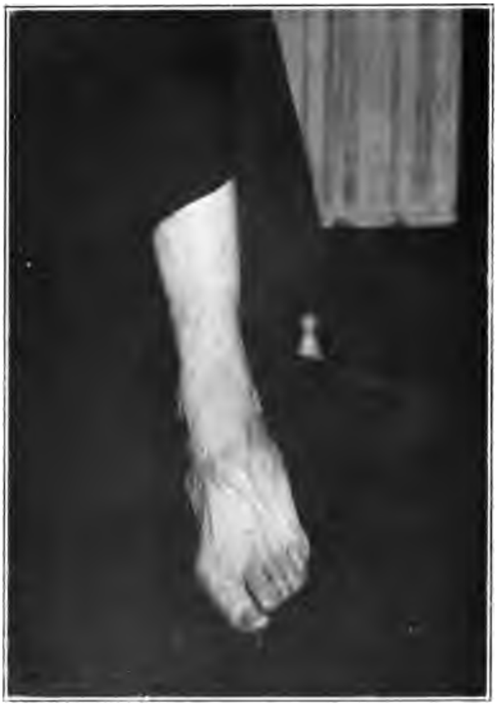

Fig. 34.—Case No. 1956. Photograph of a case of chronic eczema. Note how the skin has been restored to normal condition over the instep.

Case No. 7679

Mr. B. R. B., fifty-three years old, married. Eight months ago he brushed a mole off from the left shoulder. Since then it has begun to grow. It is now the size of a quarter, red and indurated.

Diagnosis.—Chronic dermatitis on the left shoulder. (Fig. 35.) He has remained well for several months following three treatments.

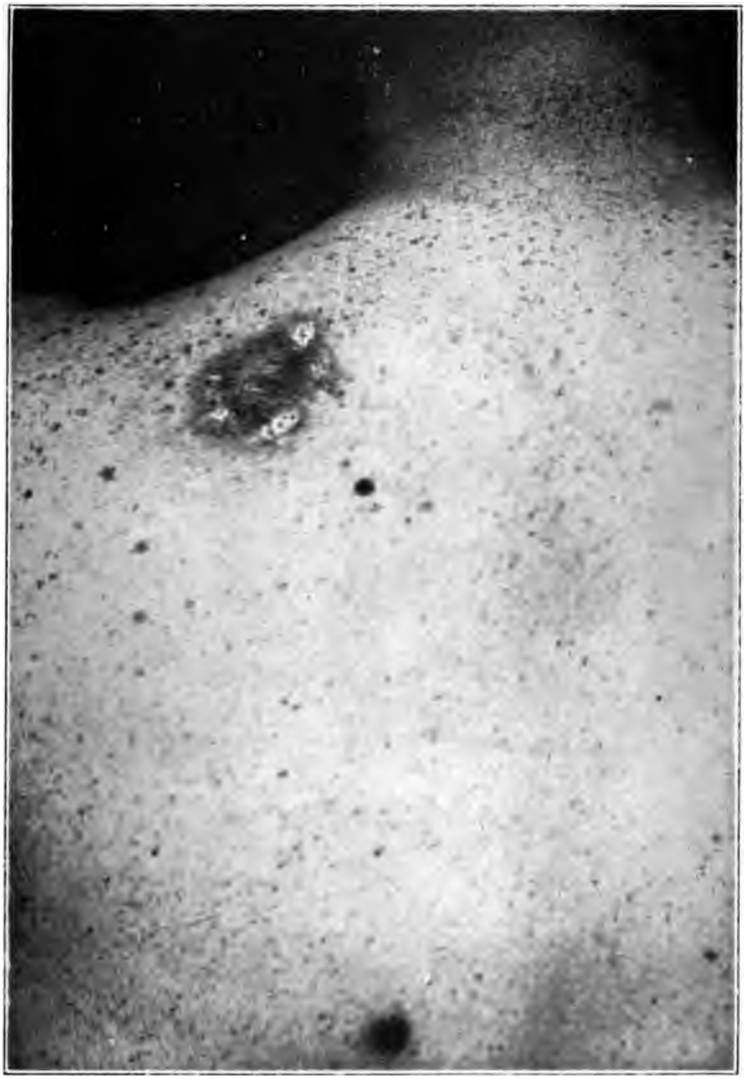

Fig. 35.—Case No. 7679. A patient with a chronic dermatitis over the left shoulder posterior, before treatment. It disappeared entirely after three treatments.

Case No. 4821

Mr. R. D. B., twenty-seven years old, lather. For two years he has had eczema on the right hand in the region of "Cardinal's snuff box." Medical treatment was of no help. There is now an area three inches in diameter.

Results.—He is entirely well two and one-half years after treatment, the fractional dose method being used.

Case No. 4612

Miss R. W., nineteen years old. Since three years of age she has had an elevated patch on each shin about one and one-half inches wide extending the whole length of the shin. There is no pain but the skin is thick, elevated, pigmented and scaly.

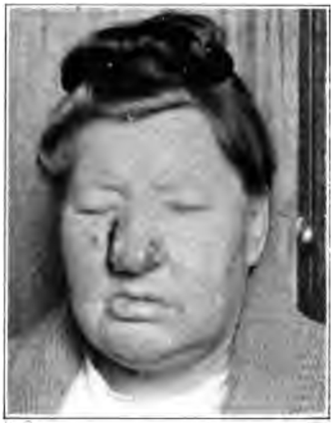

Fig. 36.—Case No. 7539. Patient with marked lupus vulgaris. Responded to treatment.

Diagnosis.—Chronic dermatitis.

Results.—Entirely well after two and one-half years.

Case No. 7539

Mrs. A. H., fifty-five years old. Last spring she had a pimple on the right side of the nose. Later, one came on the left side of the nose. It gradually spread till now the left ala of the nose has an ulcer area the size of a quarter, while the right side is the size of a dollar. There is a marked crust formation and redness surrounding it.

Diagnosis.—Lupus vulgaris.

Results.—Well after four treatments. (Fig. 36.)

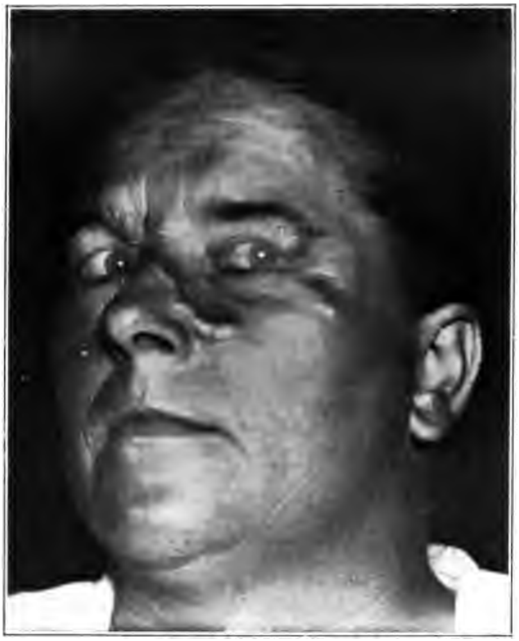

Fig. 37.—Case No. 6581. A case of lupus erythematosus before treatment. Entirely well to date.

Case No. 5462

Mrs. G. M. E., forty-nine years old. About seventeen years ago a spot the size of a pinhead appeared on the left side of the nose about the middle. It scaled, then reformed. She had no treatment until one year ago when she had the "violet ray" treatment.

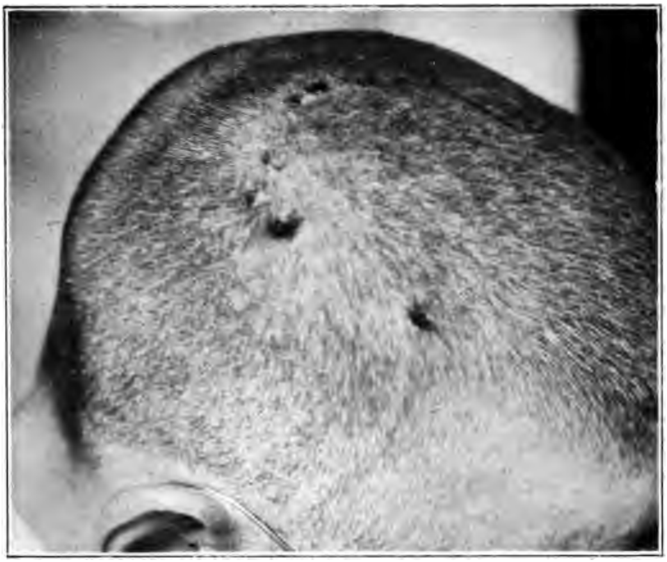

Fig. 38-*A*.

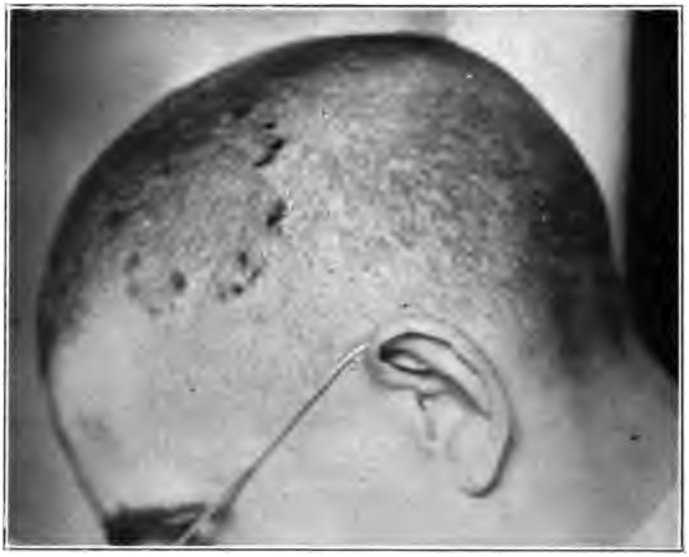

Fig. 38-*B*.

Figs. 38-*A* and *B*.—Case No. 8550. Photograph of patient with ringworm, **showing** the method of clipping the hair preparatory to roentgen treatment.

Examination showed a long scar extending down from the middle of the nose to the left malar prominence and two red areas near the malar prominence.

Diagnosis.—Lupus vulgaris.

Results.—She is well one year after treatment.

Case No. 6581

Mrs. C. W. C. For the past seven years she has had a red area of skin over the upper part of the left side of the face and forehead. The margin is elevated and darker in color than the center. It spreads slowly from the margin.

Diagnosis.—Lupus erythematosis.

Results.—She has had two series of superficial treatments and has been well for six months. (Fig. 37.)

Case No. 8560

P. H. K., forty-seven years old, married. For the past two years he has had sore spots on both sides of the crown of the head.

Examination.—Circle-like elevated area on both parietal regions.

Diagnosis.—Tinea trichophytina. (Fig. 38.)

Case No. 7249

Mr. V. K. Three months ago he had a boil on the right wrist at the base of the thumb and it has not healed. Examination shows an indurated place in the skin one-half inch in diameter within which the hair follicles are infected.

Diagnosis.—Epithelioma.

Results.—Entirely well four months after treatment. (Fig. 39.)

Case No. 3592

Mr. F. M., thirty-eight years old. About three years ago a barber picked a hair from the side of his face. He noticed pain immediately after. He went to a doctor the same day who incised the affected part. It did not heal. Five or six months later he was injured by a cow and a month after this while eating a meal, he noticed a

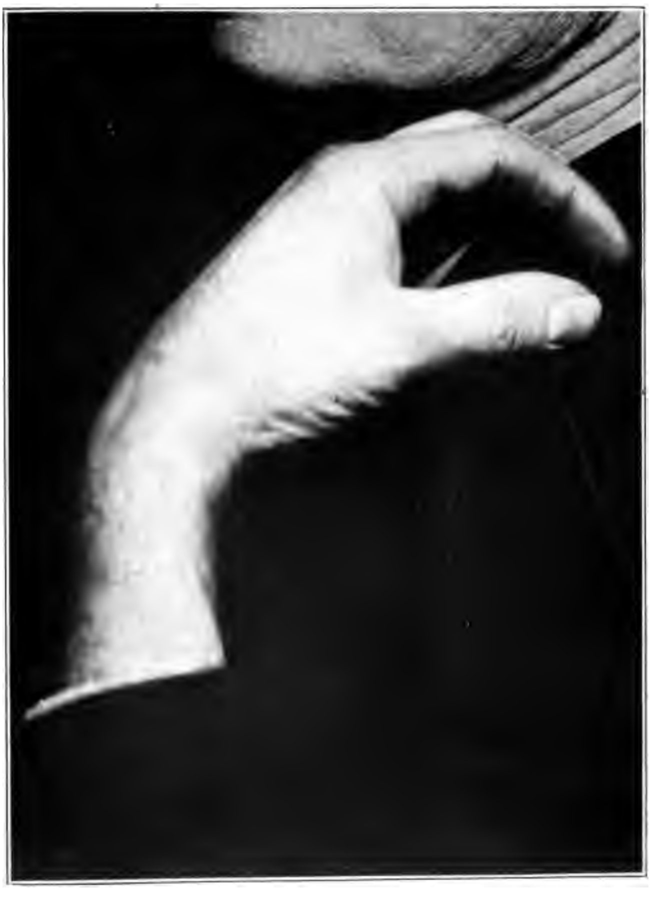

Fig. 39.—Case No. 7249. Patient with an epithelioma in the region of the Cardinal's snuff box, after treatment, showing complete disappearance.

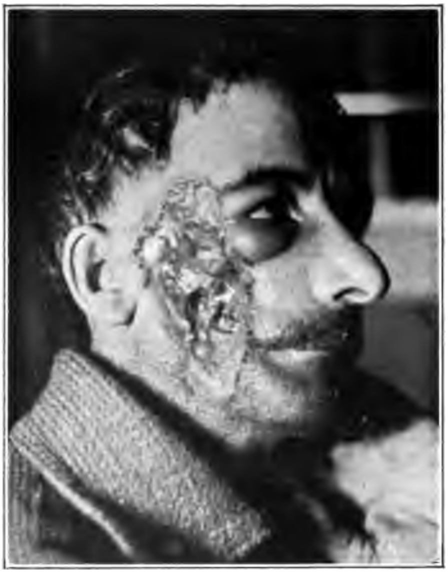

Fig. 40.—Case No. 3592. Marked destruction of the right cheek extending through into the mouth so the molar teeth show through the opening. Operated twice with recurrence. Referred for roentgen therapy. Entirely healed after three months and is still well after two and one-half years.

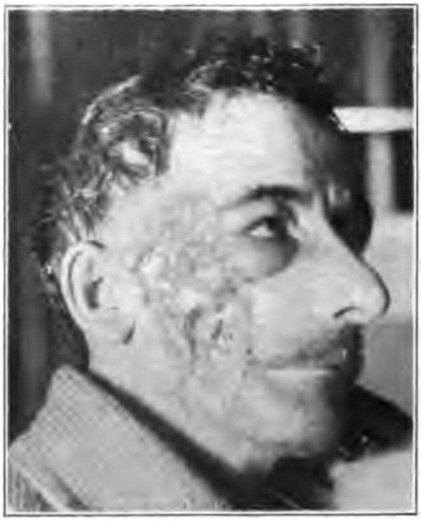

Fig. 41.—Case No. 3592. Same patient as in Fig. 40 when one-half the treatment had been administered, showing the healing process taking place about the edge of the wound.

clear discharge from the side of the face run down on the outside. This was in the region of Stenson's duct. A few weeks later he was treated in the hospital for a month. He left and returned in a week at which time he was operated. He stayed in the hospital three months and was discharged with the sore almost healed. After being out some time the sore began to enlarge. It was treated in different places by different physicians without results. A year from the time he left the hospital he returned with the sore covering almost the entire right side of the face with a very foul smelling discharge.

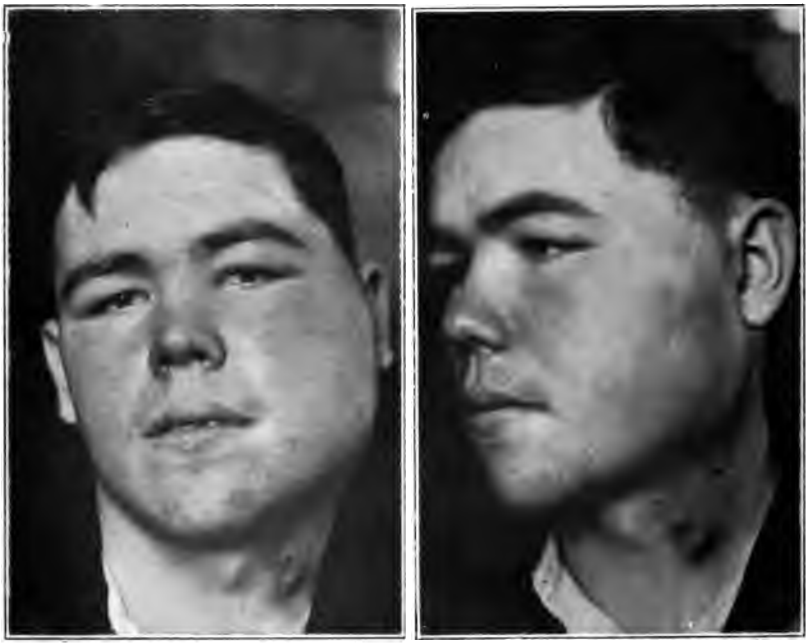

Fig. 42-*A*. Fig. 42-*B*.

Fig. 42-*A*.—Case No. 7465. Chronic case of actinomycosis, the fungi being found in large numbers on microscopic examination. Note the intense swelling of the parotid region and the sinus opening down on the neck.

Fig. 42-*B*.—Case No. 7465. Side view of the same patient.

The cheek was destroyed so that the molar teeth could be seen from the outside.

Treatment.—He was referred for roentgenotherapy by the surgeon. One series of treatments carried to the point of vigorous erythema, resulted in eradication of the disease. Skin graft closed the opening in the cheek. He is still well after two years. (Figs. 40 and 41.)

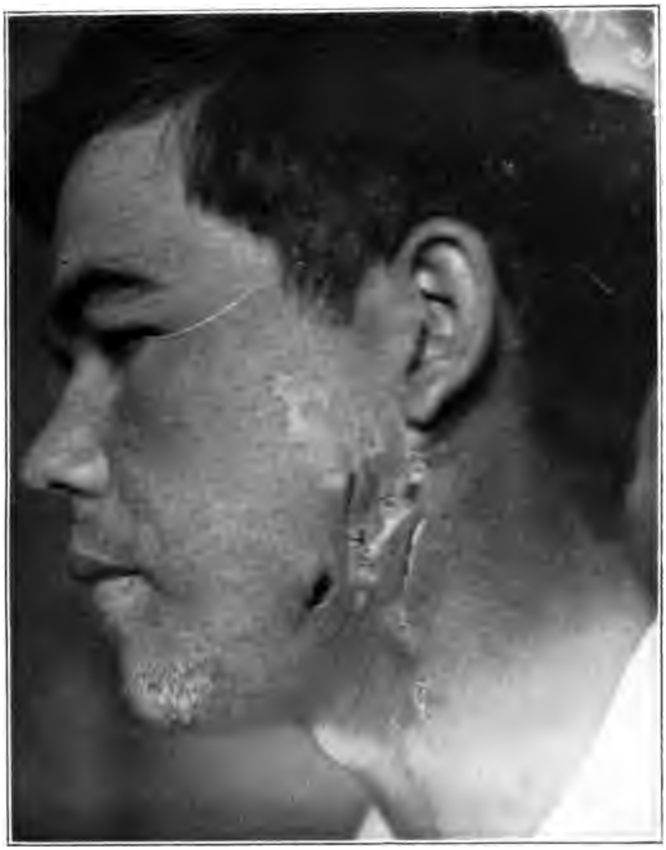

Fig. 43-*A*.—Case No. 7465. Same patient as in Fig. 42, after treatment. The scars were made by lancing the areas as they became soft.

Case No. 7465

Mr. C. S., eighteen years old. Patient complained of pain and swelling of the left side of the face. The condition started eight months previous with what the patient termed a boil on the left side of the neck with the left side of the face swollen. During this time and previous to this the patient had been continually with horses

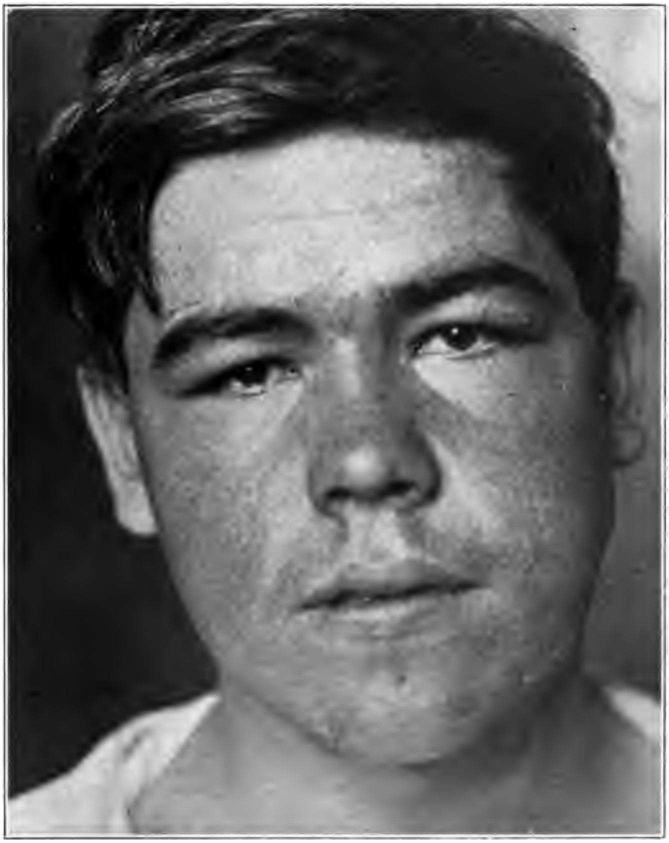

Fig. 43-*B*.—Case No. 7465. Same patient as in Fig. 42, after treatment.

and cattle. These were all healthy so far as the patient knew. He admits the habit of chewing straw and hay continuously. One month later, the boil was opened and a glass drain put in. The patient says this discharged a bloody pus and in about two weeks all swelling of the face and neck was gone but a small hard lump remained under the angle of the inferior maxilla. Then he was apparently well except for the lump and the spot where the glass tube was inserted, which would not heal. About six months later his face began to swell again

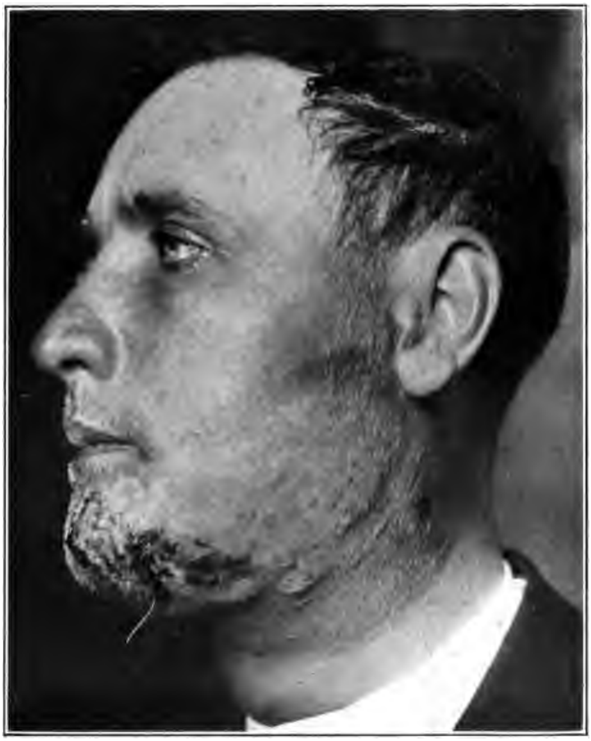

Fig. 44.—Case No. 8040. Patient with early actinomycosis involving the entire face from ear to ear over the region of the lower jaw. Responded to three treatments and is now entirely well.

and has remained so since. A few days ago he says that it broke open at the spot where the glass tube was previously inserted and it discharged a little.

Diagnosis.—Probable actinomycosis, confirmed later by microscopic examination of the pus. (Figs. 42-*A* and 42-*B,* 43-*A* and 43-*B.*)

Results.—Well for six months after treatment.

Case No. 8040

Mr. S. W. C. For the past month he has had suppurating areas in the skin about the lower jaw. Pus exudes about the hairs in which there are small hard grayish granules. There is much pain.

Diagnosis.—Actinomycosis.

Results.—Well after two treatments. (Fig. 44.)

Case No. 4828

Mrs. F. S. M. Seven years ago she began to be nervous and have heart trouble. Six years ago she was operated at the Mayo Clinic where they removed the left side and isthmus of the thyroid. Four years ago a baby girl came, there was no trouble. She continued well until December, 1916, when she began to feel nervous and the right side of the neck swelled. Physical examination showed a large palpable right thyroid extending down behind the sternum. Her pulse was 120 and she was very nervous. Roentgenogram showed a large thyroid and possible thymus.

Results.—She has had three series of deep roentgen therapy treatments and is entirely well after one year. She does her usual household and social duties with no return of symptoms. The tumor has disappeared entirely.

Case No. 6343

Mrs. R. E. S., twenty-nine years old. For two years she has had a large goiter. This appeared after a period of hard work. She was very nervous and took the rest cure one year ago. She has a choking sensation and aches all over as though she had the grip.

Examination.—Pulse 120 sitting, some tremor of hands. Eyes prominent and nervous. Enlarged thyroid.

Results.—Thirteen days after the first treatment the pulse was down to 80, the choking sensation was gone and she had no aching. She has remained well one year.

Case No. 6919

Mrs. G. W. R. For the past week she has had lumps above the right clavicle well out from the neck.

Diagnosis.—Cervical adenitis.

Results.—After four treatments the glands had entirely disappeared and they have not returned in four months.

Case No. 7555

Mrs. H. C. C., thirty-five years old, married. Five months ago she had enlarged glands on the left side of the neck following an infected tonsil. The tonsil was removed. Two months ago she had the glands removed. She still has enlargement and stiff neck with a sinus which allows liquid to come through the neck when she swallows.

Diagnosis.—Tuberculous adenitis with sinus.

Results.—After two treatments the glands on the left side of the neck softened and were incised. Since drainage the induration in the side of the neck has disappeared and the sinus has closed. (Figs. 45 and 46.)

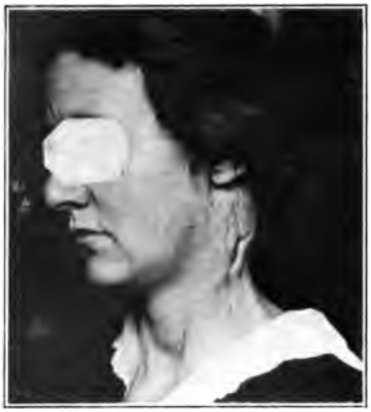

Fig. 45.

Fig. 45.—Case No. 7555. Patient with tuberculous sinus communicating with the throat and opening on the skin on the left side of the neck. Marked enlargement of the glands above the sinus. Patient well after a few treatments, the sinus having entirely closed and the glands having disappeared.

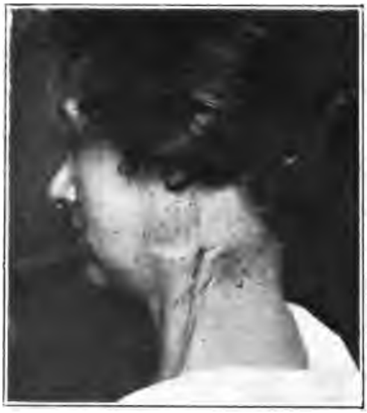

Fig. 46.

Fig. 46.—Case No. 7555. Posterior view of the same patient as shown in Fig. 45, showing the sinus.

Case No. 6619

C. D., twelve years old, schoolboy. About one month ago he had a lump begin on the outer side of the right side of the neck. It kept getting larger until now it is

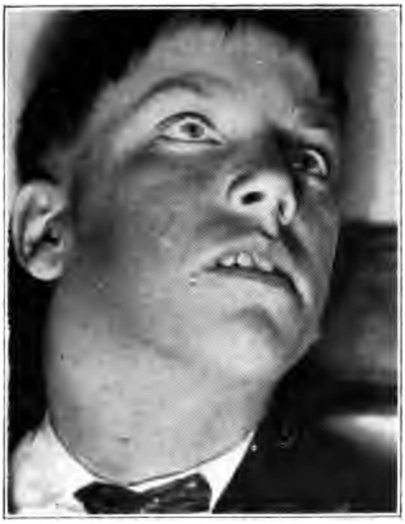

Fig. 47.—Case No. 6619. Patient with very large cervical glands, the result of tuberculous infection.

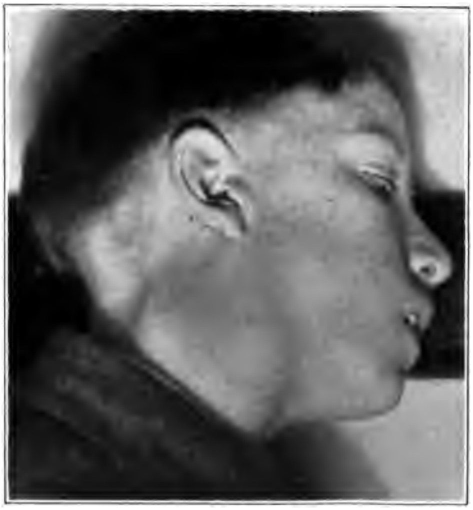

Fig. 48.—Case No. 6619. Side view of same patient as in Fig. 47, before treatment.

as large as a goose egg. Separate glands can be felt. He has a positive Moro test.

Diagnosis.—Tuberculous cervical adenitis.

Results.—He has had four series of deep treatments. The lump on the right side of the neck has disappeared, he has gained weight and his general health is better than it had ever been. (Figs. 47, 48 and 49.)

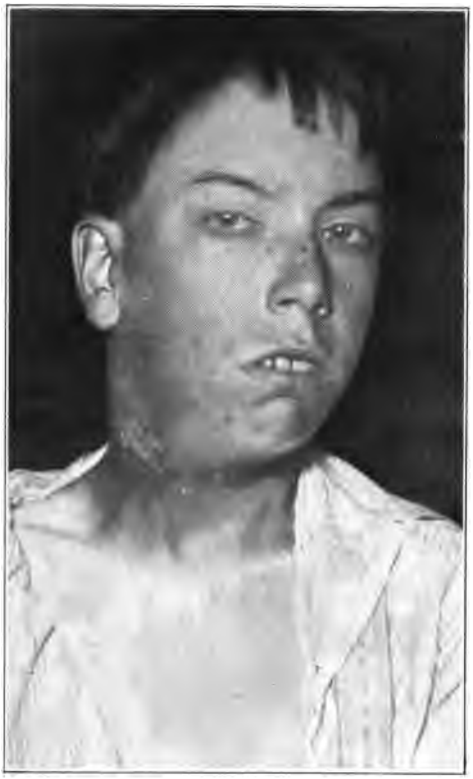

Fig. 49.—Case No. 6619. The same patient as in Figs. 47 and 48 after treatment.

Case No. 5497

E. J., thirteen years old, schoolboy. Two years ago he noticed a lump under the left arm. He now has

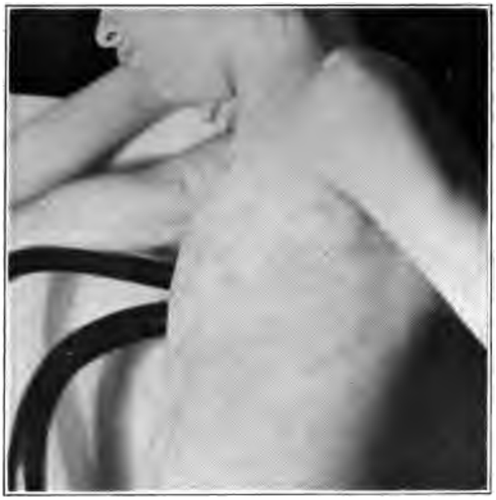

Fig. 50.—Case No. 5497. Boy of twelve with extensive Hodgkin's disease. Note the enlargement of the glands in the axilla, supraclavicular and cervical regions.

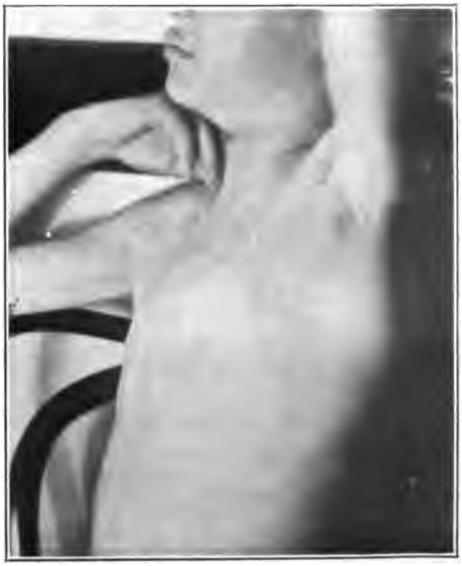

Fig. 51.—Case No. 5497.—Note the enlarged glands in the axilla.

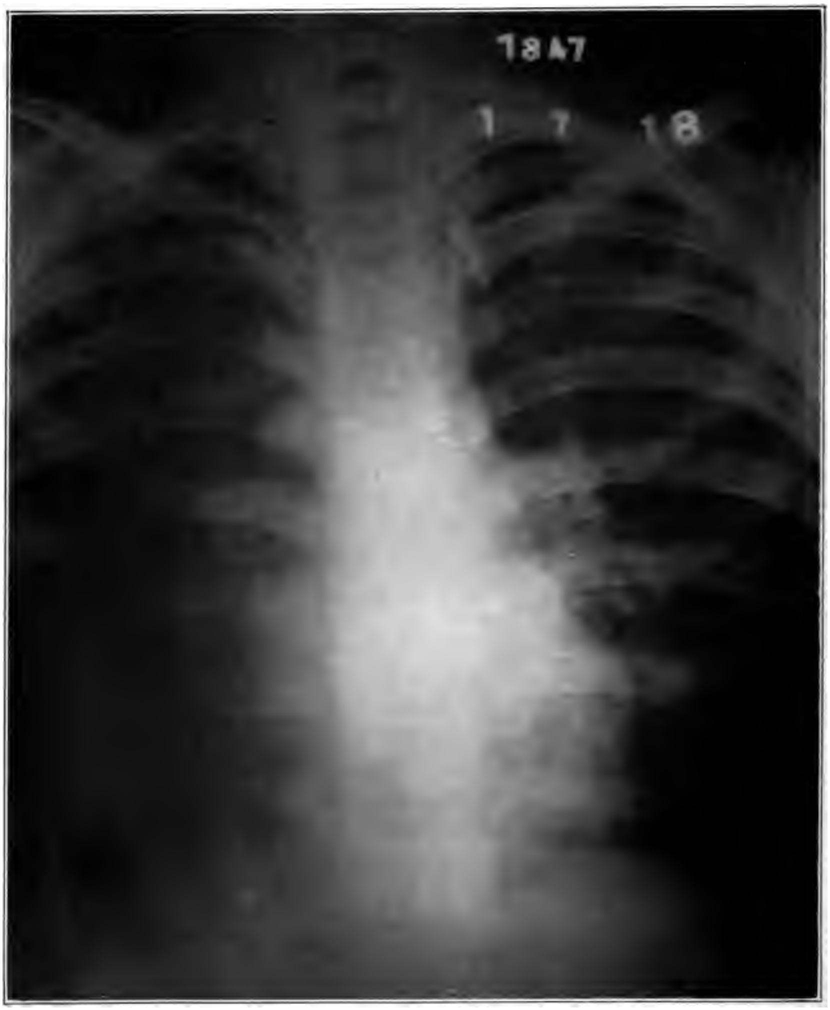

Fig. 52.—Case No. 5497.—Roentgenogram of the chest of the same patient, shown in Figs. 50 and 51, after one series of deep roentgen treatments. Note the decrease in the size of the glands in the mediastinum.

lumps on both sides of the neck and left axilla, left supraclavicular glands and mediastinal glands. He is compelled to sit up to sleep.

Diagnosis.—Hodgkin's disease.

Results.—He has had four series of deep treatments. He has improved as shown by the roentgenograms of his chest, has grown rapidly in size, has gained strength and is able to do everything a boy of his age can do. He has been well more than a year. (Figs. 50, 51 and 52.)

Case No. 6156

Mrs. G. G. W., thirty-seven years old, married, 3 children—5, 7 and 14 years old. Last summer she was weak but did not consult a physician. In December, 1916, she was worse, then better. In March, 1917, she went to a physician who found a lump under the left ribs. She has no pain but feels weak and dragging and has lost "pep." White blood count, 74,000.

Diagnosis.—Splenic leukemia.

Results.—She has had four series of treatments. When she came for treatment, June 11, the white cell count was 74,000, on June 26 the count was 9,000 whites. Three months later, the white cells had increased to 30,800. Four months later, following the second series, the count was 15,000. At the end of seven months, with no further treatment, the white cell count was only 12,000.

Case No. 5287

Mrs. H. O. C., thirty-eight years old, married, 2 children—9 and 14 years old. About six months ago she noticed a lump under the left ribs accompanied by an increasing weakness.

Examination showed a large spleen with blood count 13,000 whites.

Diagnosis.—Splenomegaly.

Results.—She has had two series of treatments with eleven months intervening between them. Before the first series her white cell count was 13,000. Eleven months later, before the second series of treatments, the count was 6,500. The spleen was barely palpable.

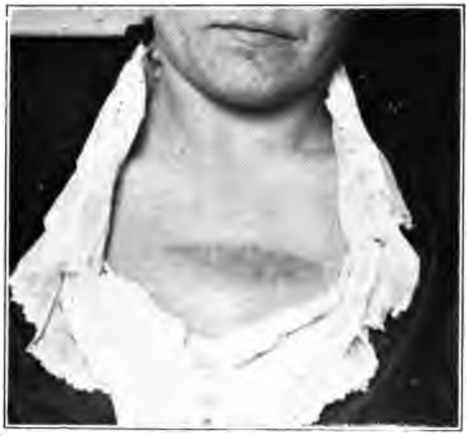

Fig 53.—Case No. 2254. Keloid following operation for removal of sebaceous cyst. Before treatment this keloid stood one-half inch above the skin and about one and one-half inches wide by three and one-half inches long. This photograph was made after treatment when the tumor had entirely disappeared, leaving the skin soft and pliable, only the scar showing.

Case No. 2254

Mrs. L. A. L. Two years previous she had a large sebaceous cyst removed from the chest over the middle of the sternum. Following the removal of the cyst, a keloid developed, being one and one-half inches wide, one-half inch high, and three and one-half inches long. The tumor was painful, the patient wishing it removed for this reason and for cosmetic reasons.

Results.—An erythema dose of roentgen rays filtered through four millimeters of aluminum caused the tumor to disappear. She has been well three years, the scar being flat, soft, and pliable. (Fig. 53.)

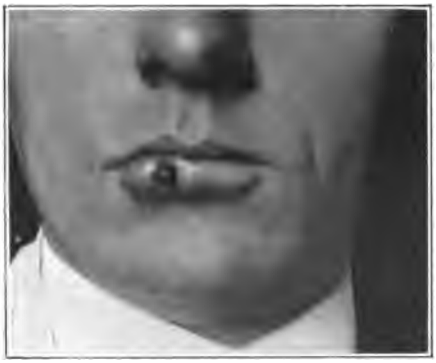

Fig. 54.—Case No. 7663. Patient with a small angioma on the right half of the lower lip. It had resisted cauterization. Entirely relieved by electro-thermic coagulation and three deep roentgen treatments.

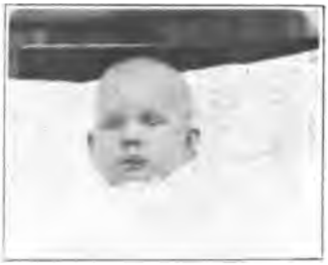

Fig. 55.—Case No. 6754. Baby girl with an extensive nevus on the left half of the upper lip. This was of the vascular type, making the lip very thick. Entirely relieved after electro-thermic coagulation and four deep roentgen treatments.

Case No. 7663

Mr. L. A. D., twenty-nine years old, married. About three weeks ago he had a blister on the right half of the lower lip the size of a belt pinhead. Two weeks later he had the lip cauterized. It has returned and is the size of a large pea.

Diagnosis.—Angioma.

Results.—The lip healed nicely after electrothermic coagulation and an erythema dose of filtered rays and he has remained well several months. (Fig. 54.)

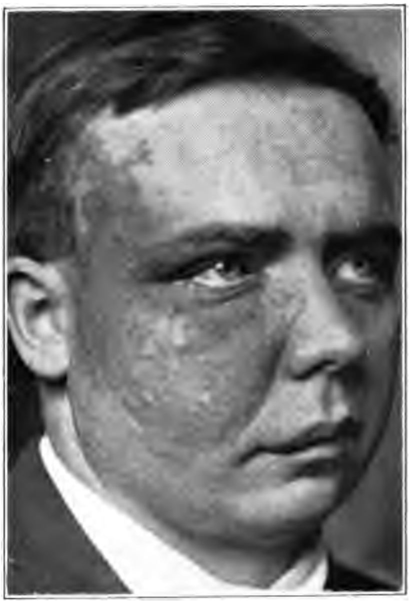

Fig. 56.—Case No. 7140. Extensive portwine stain involving the right half of the face. Considerably relieved by roentgen treatment.

Case No. 6754

Baby K., four months old. Shortly after birth a vascular nevus appeared in the left half of the upper lip. It has increased in size and now it involves the left half of the lip extending into the left nostril.

Results.—She has had two series of deep therapy treatment combined with electrothermic coagulation. The lip is normal in color and shape with scarcely a visible scar. (Fig. 55.)

Case No. 7140

Mr. W. E. E., twenty-four years old. Since birth he has had a portwine stain covering the right cheek, forehead and right half of the upper lip. It is vascular in the lip.

Diagnosis.—Portwine nevus.

Results.—It has receded one-fourth inch along the posterior margin from the first treatment. Subsequent treatments caused it to gradually fade in color till almost the color of the normal skin. (Fig. 56.)

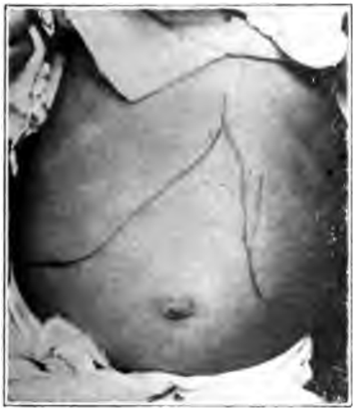

Fig. 57.

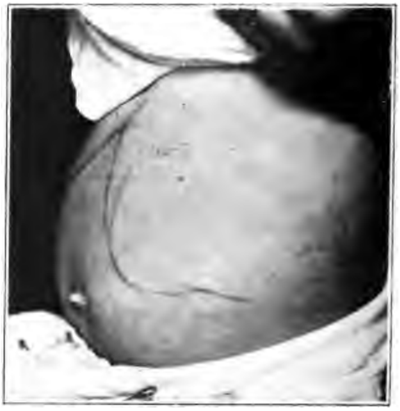

Fig. 58.

Fig. 57.—Case No. 7953. Front view of a fourteen-month-old baby with Banti's disease. Note the marked enlargement of the spleen and of the liver. The spleen returned to normal size after five treatments.

Fig. 58.—Case No. 7953. Side view of the same patient as in Fig. 57.

Case No. 7953

Baby B., fourteen months old. For the past two months she has had a swelling in the left side of the abdomen.

Examination.—The liver is three inches below the costal margin, the spleen to the median line. Blood count—whites normal. Reds show a pronounced anemia and poikilocytosis.

Diagnosis.—Splenic anemia (Banti's disease).

Results.—After an erythema dose of roentgen rays

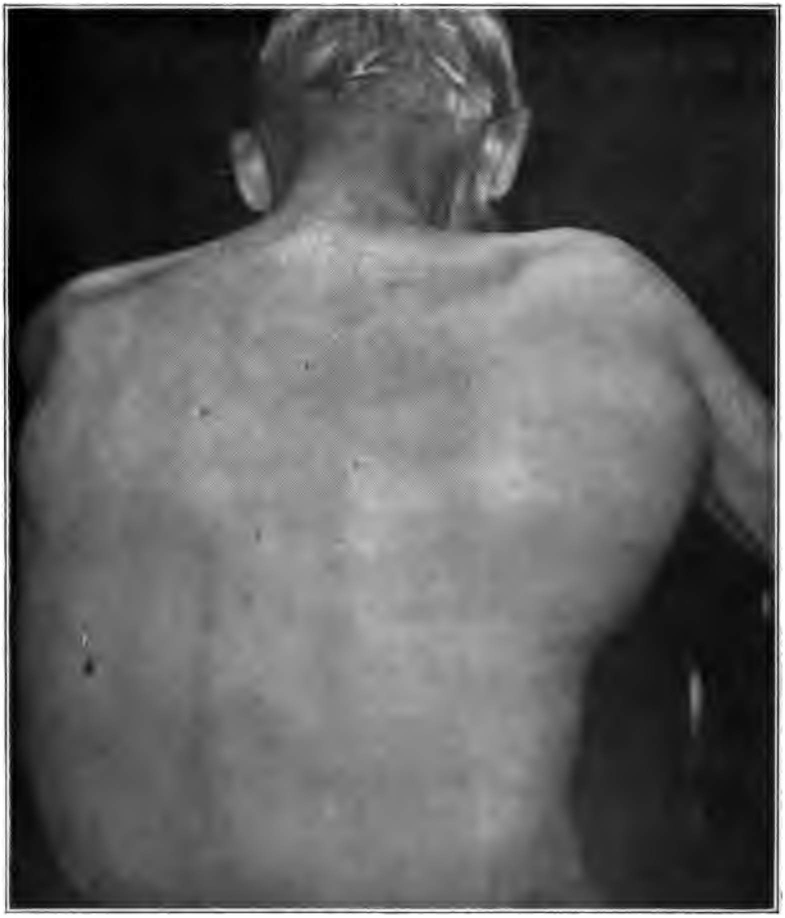

Fig. 59.—Case No. 6524. Very large sarcoma under the right shoulder girdle lifting the scapula well off the chest and making it impossible for the arm to be put down by the side further than is shown in the photograph. Marked response to heavy roentgen therapy. Death came before treatment was completed. Death due to uremia.

filtered through five millimeters of aluminum and sole leather, the spleen and liver returned to normal size and have remained so for several months. (Figs. 57 and 58.)

Case No. 6524

Mr. A. B., sixty-seven years old, married. For several months he has had a lump under the right arm. It was lanced and only blood came.

Examination.—Tumor in the right axilla the size of a man's head.

Diagnosis.—Sarcoma.

Results.—The tumor decreased more than one-half in size after two series of deep roentgen treatments. While at home several weeks after the second series, he was taken with uremia and died. The improvement in the tumor was marked. (Fig. 59.)

Case No. 8030

Mrs. G. C. E., thirty-four years old, married. November, 1917, tears from the left eye began to run over the cheek. There was no pain. Lumps appeared in the side of the neck. They were removed. She now has a recurrence.

Examination.—Large lumps in the left parotid and cervical regions. A lump at the inner canthus of the left eye. She can scarcely breathe through the left nostril. The left palate is depressed. Teeth are out of occlusion. Roentgenogram shows the left antrum very dense. (Fig. 61.)

Diagnosis.—Sarcoma of the antrum and adjacent lymphatics.

Results.—After two series of deep roentgen treatments the lumps have entirely disappeared from the inner canthus, parotid and cervical regions. She is able to breathe through the left nostril normally, the left half of the palate has receded and the teeth occlude. She has remained well several months. We expect to treat her several more times during the first year. (Figs. 60 and 61.)

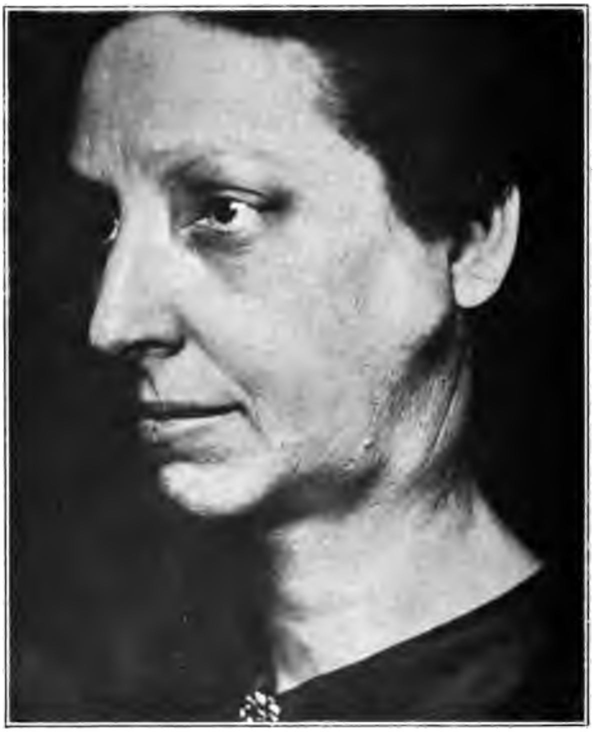

Fig. 60.—Case No. 8030. Patient with sarcoma of the left maxillary sinus with metastasis at the inner canthus of the left eye and in the parotid and cervical glands. Operated for removal of the glands, with recurrence, as shown in the photograph. Entirely well after three series of deep roentgen treatments.

Case No. 2125

Mrs. M. McG., forty-five years old. About three years ago she noticed a swelling of the left cheek which depressed the palate on that side and interfered with breathing through the left nostril. A little later a growth

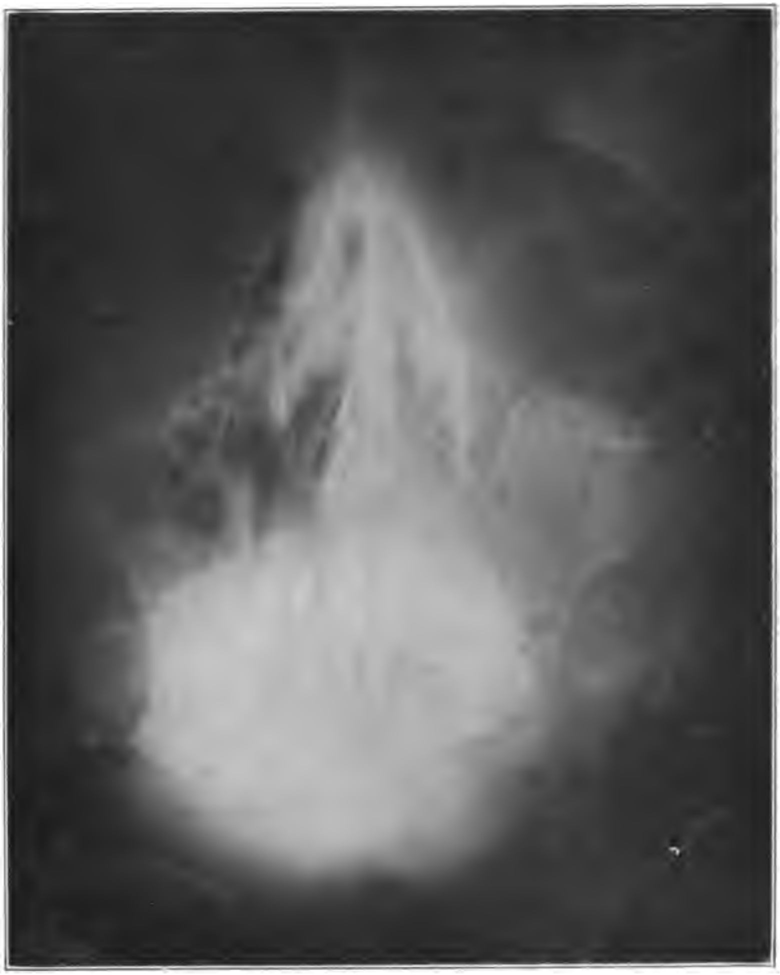

Fig. 61.—Case No. 8030. Roentgenogram of the patient shown in Fig. 60. Note the marked density in the left maxillary sinus due to the sarcoma.

appeared in the socket of the left upper bicuspid tooth and was pronounced sarcoma by the attending physician. She had the growth curetted but it returned in a short time and was curetted again, this time the maxillary sinus being opened through the alveolus. In a short time the growth returned again when she was referred for roentgen therapy.

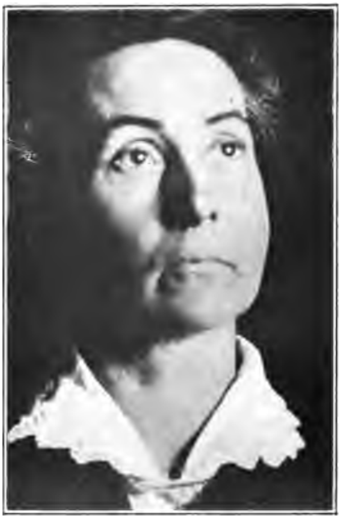

Fig. 62.—Case No. 2125. Patient with sarcoma of the antrum which had broken through the alveolar process into the mouth. Had been operated twice with recurrence. Well after four series of treatments.

Examination.—The left half of the palate is depressed, a large fleshy growth is protruding through the alveolus. The bicuspid and molar teeth have been removed.

Diagnosis.—Sarcoma involving the left maxillary sinus and alveolus.

Results.—After two series of roentgen treatments the growth entirely disappeared and she is well four years afterward. (Fig. 62.)

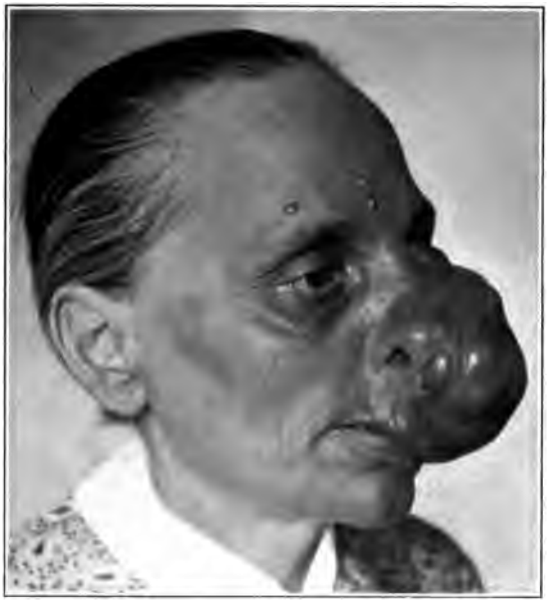

Fig. 63.

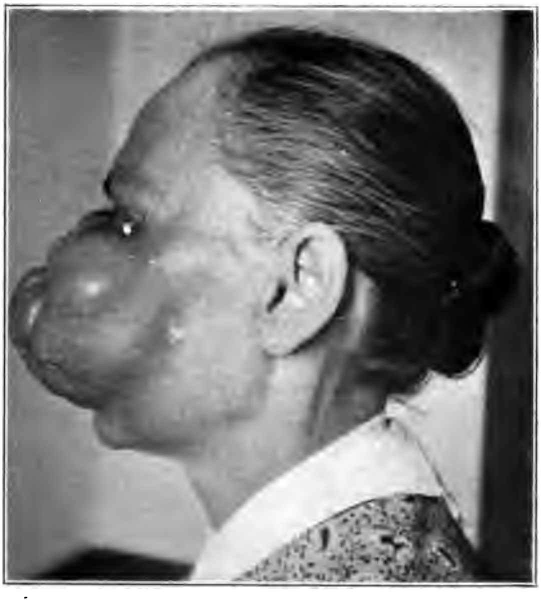

Fig. 64.

Figs. 63 and 64.—Case of advanced sarcoma of the maxillary sinus which had ruptured through the outer wall, protruding through the cheek. The tumor moved surgically, the patient dying from the shock. Photograph reproduc to show the extent of a neglected case of sarcoma. Not treated by roentge

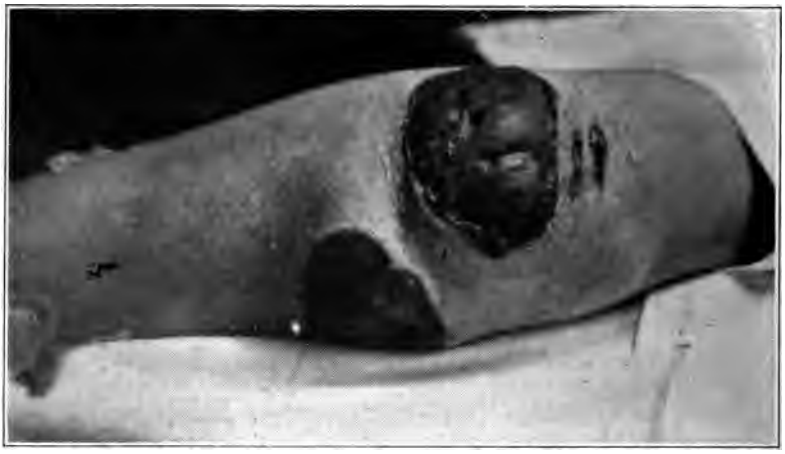

Fig. 65.—Photograph of a periosteal sarcoma springing from the lower end of the femur, protruding through the incision which had been made at various times by different physicians who thought it was an abscess. Characteristic late appearance of sarcoma so treated. Periosteal sarcoma seldom, if ever, is amenable to roentgen therapy. This patient treated surgically by amputation with good recovery.

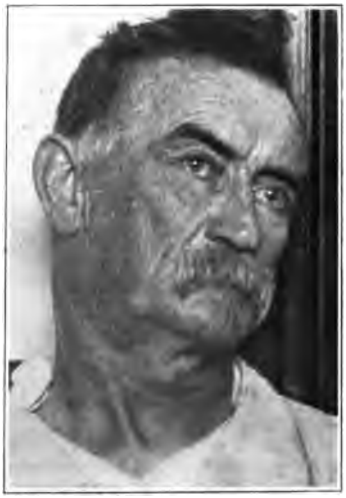

Fig. 66.—Case No. 6449. Lymphosarcoma in the right side of the neck with mediastinal involvement.

Case No. 6449

Mr. A. A. H., seventy years old, carpenter. Last winter he fell off a twelve-foot scaffold striking on the right

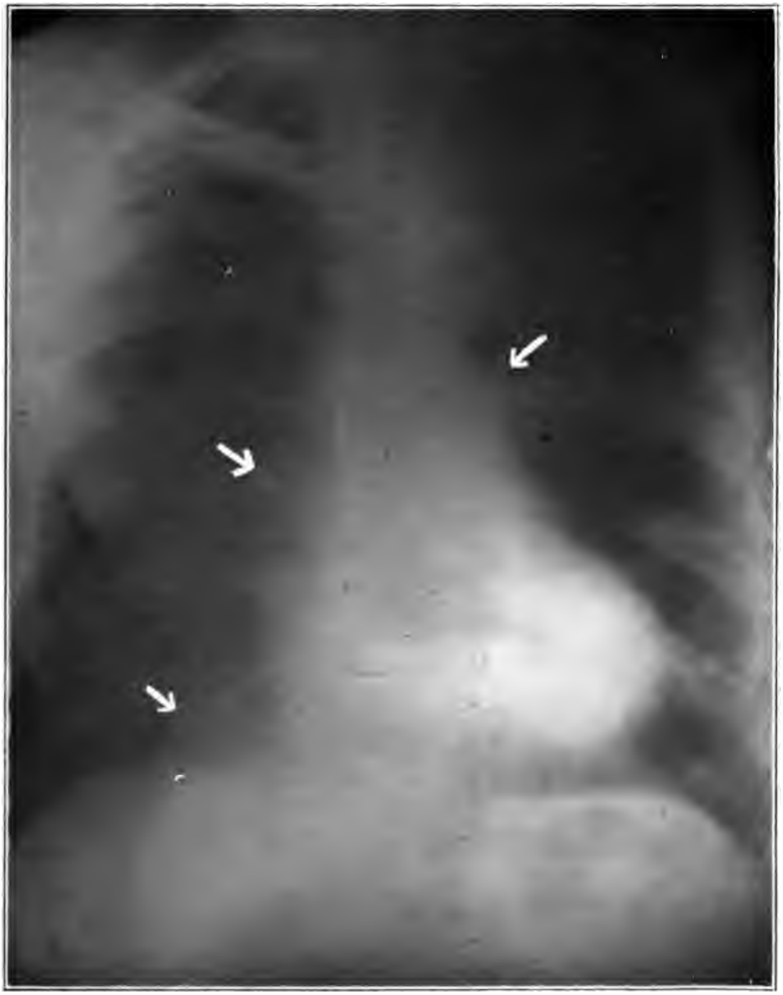

Fig. 67.—Case No. 6449. Roentgenogram of patient shown in Fig. 66, the arrows pointing to involvement of the mediastinum. Marked improvement after roentgen therapy. The tumor in the neck entirely disappeared and the mediastinal glands were scarcely perceptible. The patient lived one year after treatment, dying of metastasis in the tonsils and retroperitoneal space.

shoulder and head. He had a gland removed from the right side of the neck on March 1, 1916, for diagnostic purposes. Lymphosarcoma. Blood—whites 18,000; 40 per cent small lymphocytes.

Diagnosis.—Lymphosarcoma.

Results.—He has had seven series of deep treatments. The glands have entirely disappeared from the neck and the mediastinum. See roentgenogram. When he returned for the seventh series, fourteen months after the first, his tonsils were so large that they occluded the throat, making the removal of one of them a necessity. Microscopic examination showed the enlargement due to lymphosarcoma. He also had a retroperitoneal mass the size of a fetal head. This is doubtless metastasis. (Figs. 66 and 67.)

Case No. 7320

S. D., seven years old, schoolboy. For several months he has noticed a lump in the right axillary region. It is now the size of an orange, pushing the pectoral muscles forward. A section was removed for microscopic examination showing sarcoma. It was considered inoperable because of the surrounding axillary vessels. Roentgen treatment recommended.

Diagnosis.—Sarcoma of the right axillary region.

Results.—He has had only three series of deep treatments. The mass has entirely disappeared, the axillary region remaining normal for more than three years. (Fig. 68.)

Case No. 3521

Mr. J. H. While helping with the relief work following the tornado, March, 1913, he received a severe bruise near the base of the left thumb. A lump appeared the size of a hen's egg. It was painless. Roentgenogram showed it attached to the trapezium.

Diagnosis.—Sarcoma.

Results.—He was anesthetized and the growth was fulgurated then treated with roentgen ray to active erythema. He is still well, with no signs of metastasis or recurrence, four years after the last treatment and five years after the first treatment. (Fig. 69.)

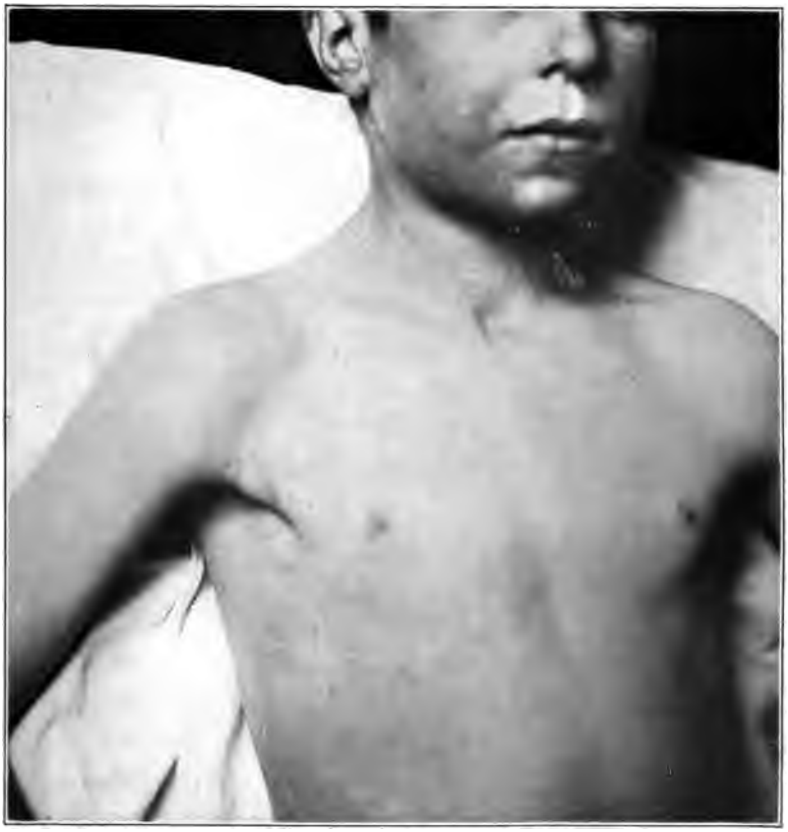

Fig. 68.—Case No. 7320. Photograph of a little boy four years after treatment for inoperable sarcoma the size of an orange in the right pectoral region. The scar was made by removal of a section for microscopic examination. No evidence of recurrence to date, four years after treatment.

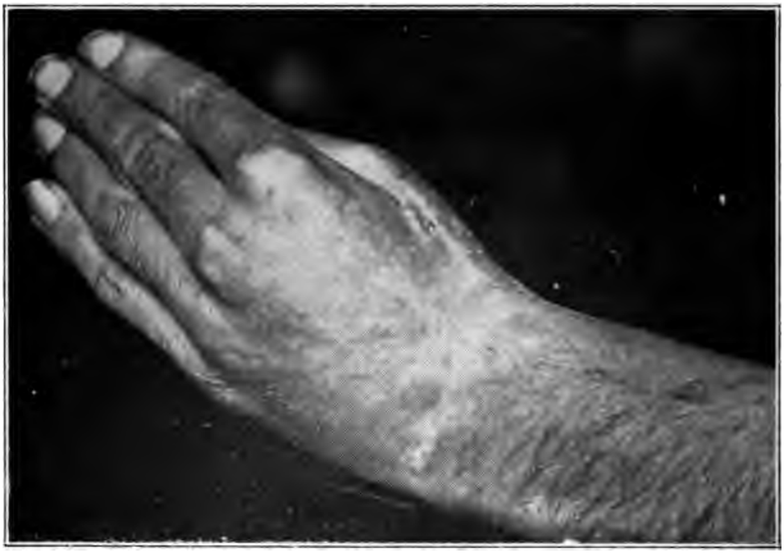

Fig. 69.—Case No. 3521. Photograph of a man's hand four and one-half years after roentgen treatment for sarcoma springing from the trapezium. No evidence of metastasis or recurrence five and one-half years after treatment.

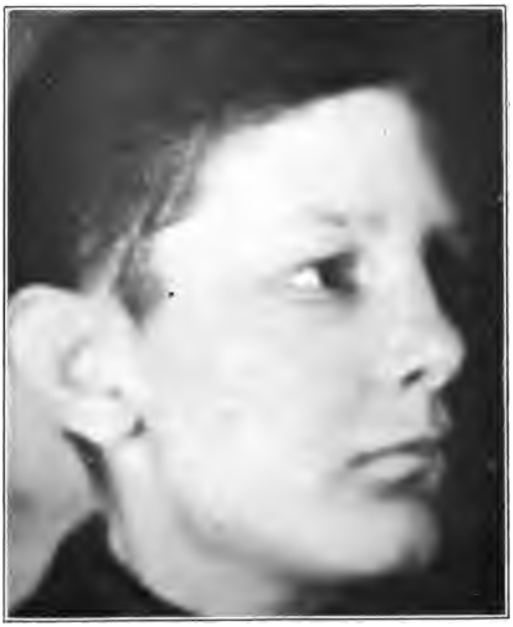

Fig. 70.—Case No. 5570. Photograph of a boy with extensive sarcoma of the right maxillary sinus, after treatment. Entirely well one year.

Case No. 5570

L. K., ten years old. About six months ago the father noticed a lump in the right cheek. At the same time he noticed a swelling in the right palate and alveolus. The father removed the bicuspid teeth. Examination showed a swelling of the cheek and depression of the right half of the palate and destruction of the upper right alveolus from the molar to the cuspid tooth.

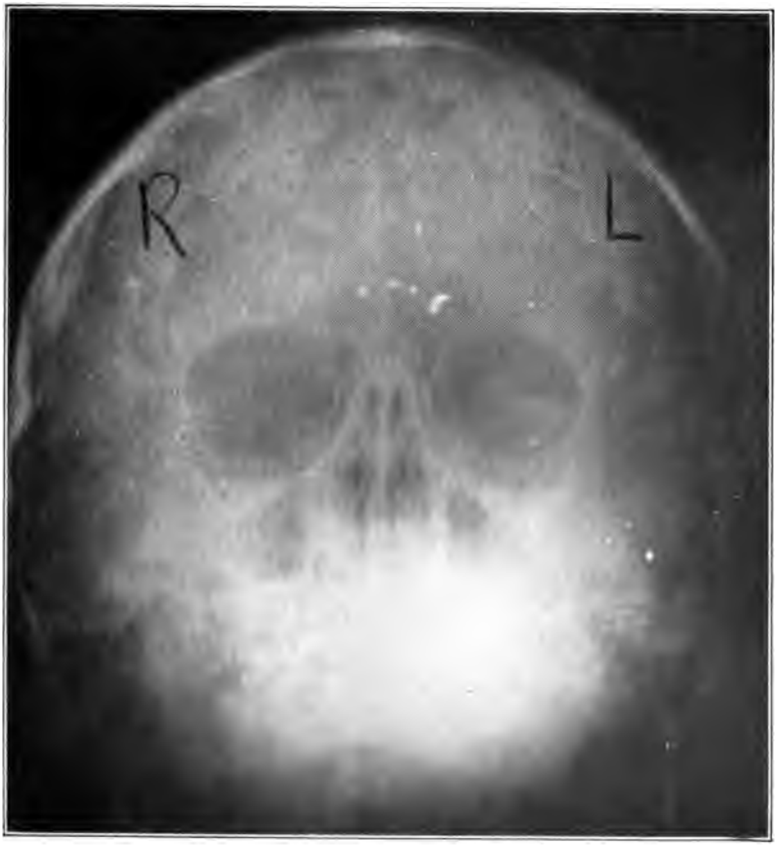

Fig. 71.—Case No. 5570. Roentgenogram of patient shown in Fig. 70, made after treatment. Note how the maxillary sinuses on both sides have the same density.

Diagnosis.—Sarcoma of the antrum.

Results.—He has had five series of deep treatments.

The swelling has entirely disappeared from the face, the palate has assumed its normal curve, the alveolus has recovered at the site of destruction and the teeth are coming down into position. The roentgen examination shows the right maxillary sinus as clear as the normal left. He has been well one year. (Figs. 70 and 71.)

Case No. 6417

R. J., four years old. During the past six months he has developed a large tumor in the right kidney region with blood in the urine. It has been called sarcoma by three physicians, the surgeon saying it is inoperable and recommending roentgen therapy. The mass is the size of a fetal head.

Diagnosis.—Sarcoma of the kidney.

Results.—He has had but two series of deep treatments. When he returned for the second series the kidney was not palpable. He has been under observation six months and has no evidence of recurrence. Two months later following a severe attack of measles, the mass reappeared in the right half of the abdomen. Roentgenogram at this time revealed a metastasis the size of a walnut in the left lung. Roentgenotherapy caused the kidney mass to become much smaller, the boy improving so that he plays about as usual. Roentgenotherapy caused a complete disappearance of the growth in the lung.

Case No. 7907

Mr. J. C., seventy-two years old. For the past two years he has had a small hard place on the right side of the nose the size of a split pea. It scales, then reforms.

Examination.—A small area of thickened brown skin.

Diagnosis.—Keratosis possibly changing to epithelioma.

Results.—Well after one erythema dose of roentgen rays filtered through one millimeter of aluminum. (Fig. 72.)

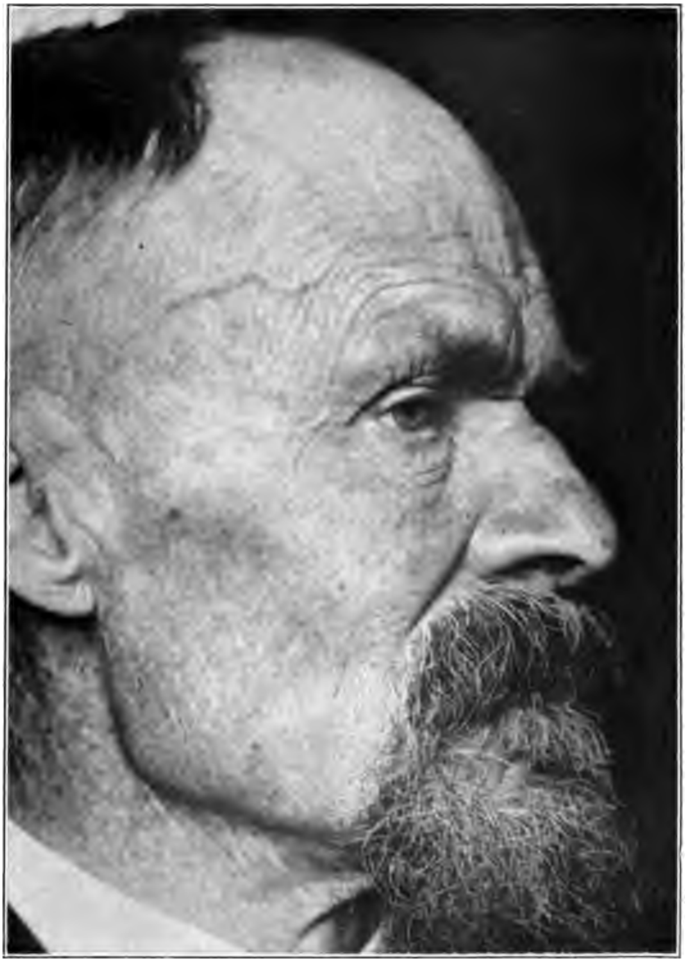

Fig. 72.—Case No. 7907. Photograph of a man with a keratosis on the bridge of the nose. Well after one treatment.

Case No. 7845

Mr. C. E. G., fifty-eight years old. For two years he has had an elevation on the left half of the upper lip. Salve was applied with no improvement.

Diagnosis.—Epithelioma of the lip.

Results.—Electrothermic coagulation followed by one roentgen treatment. Complete disappearance of the growth, remaining well more than one year.

The Hand.—For the past several months he has noticed hard scaly patches on the dorsum of the right hand as shown in the photograph.

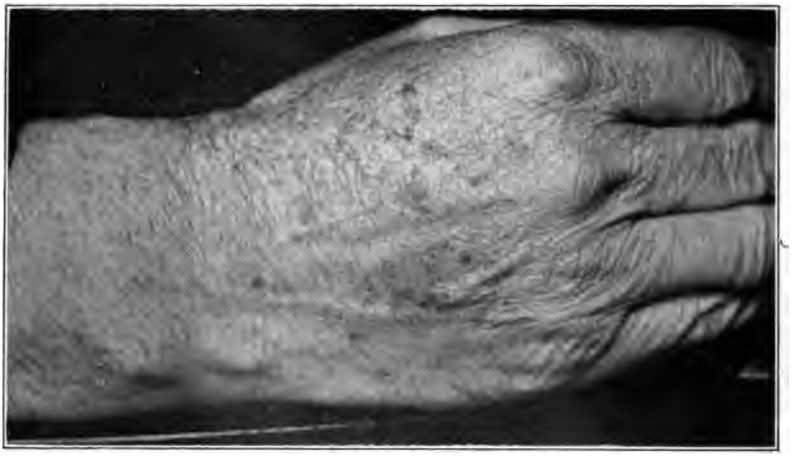

Fig. 73.—Case No. 7845. Photograph showing multiple keratoses on the dorsum of the hand. Entirely well after one treatment.

Diagnosis.—Keratoses.

Results.—After one erythema dose the keratoses entirely disappeared and the hand is well to date. (Fig. 73.)

Case No. 1925

Mr. E. T. B., forty-three years old. For the past two years he has had a hard spot in the lower lip. Lately this has begun to bleed and has increased in size rapidly

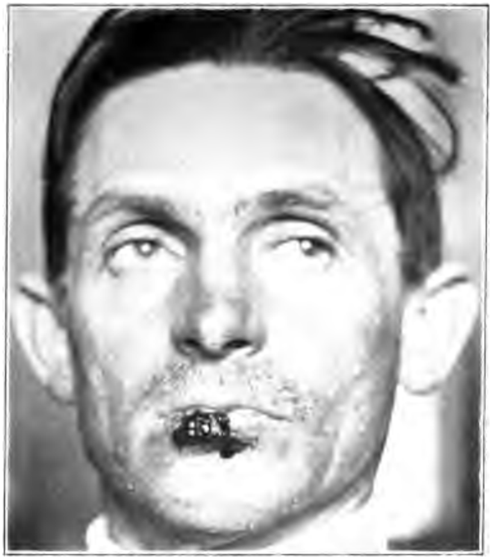

Fig. 74.—Case No. 1925. Ulcerating epithelioma of the lower lip, two years' duration.

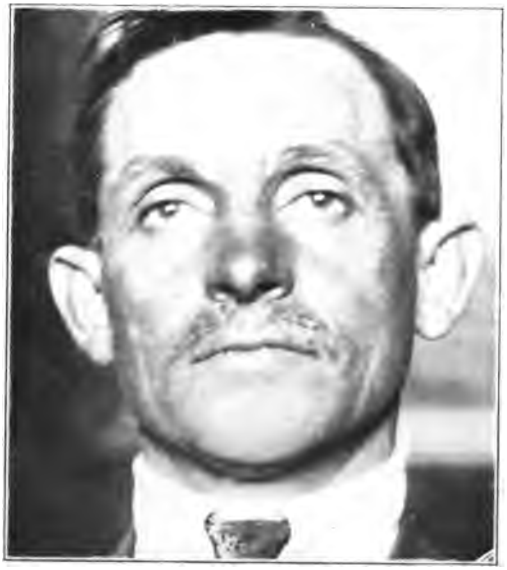

Fig. 75.—Case No. 1925. Same patient as in Fig. 74, after treatment. Well four years.

until now it is about three-fourths of an inch across and has a cauliflower appearance.

Diagnosis.—Epithelioma.

Results.—Electrothermic coagulation followed by two series of deep roentgen treatments caused the growth to disappear entirely and he has remained well four years. (Figs. 74 and 75.)

Case No. 1975

Mrs. S. N. O., seventy-six years old. About four years ago she noticed a patch on the right cheek near the ala of the nose. It would get sore, form a scab, scale off, and repeat. She now has an epithelioma near the ala of the nose on the right side, about the size of a five cent piece.

Results.—She has had eight treatments by the fractional dose method. The epithelioma has remained healed two years. (Figs. 76 and 77.)

Case No. 7218

Mrs. R. O. W., seventy-two years old. Three years ago she noticed a sore at the wing of the right side of the nose. It heals, then ulcerates.

Examination.—An ulcer the size of a pea, indurated.

Diagnosis.—Epithelioma.

Results.—After one series of roentgen treatments, the growth entirely disappeared and has remained well several months. (Figs. 78 and 79.)

Case No. 7627

Mr. T. P., fifty-three years old, married. For four or five years he has noticed a sore on the left side of the nose, then another on the right wing of the nose. It

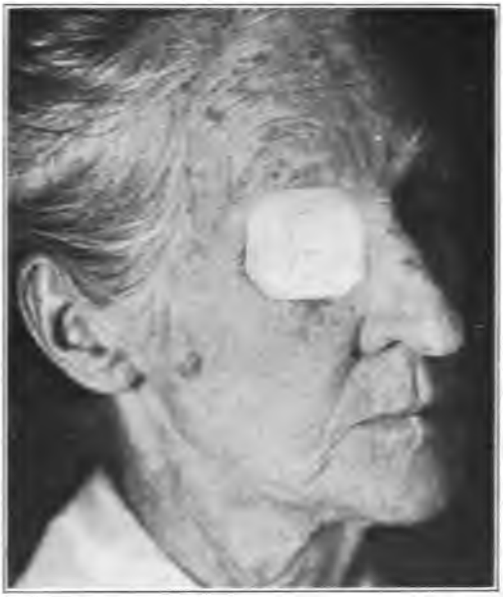

Fig. 76.—Case No. 5468. Small epithelioma under the right ala of the nose.

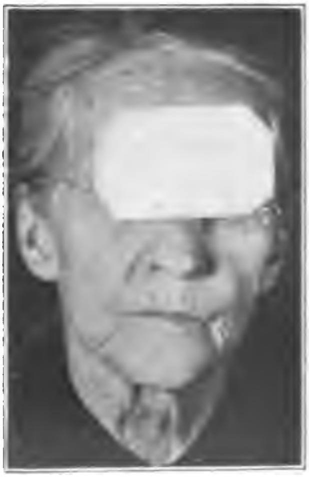

Fig. 77.—Case No. 5468. Same patient as in Fig. 76, after treatment.

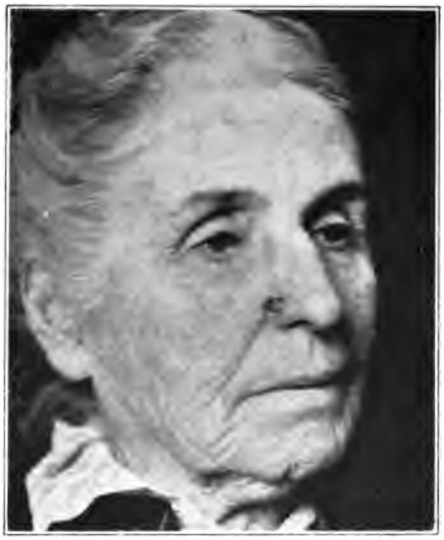

Fig. 78.—Case No. 7218. Small epithelioma under the ala of the nose.

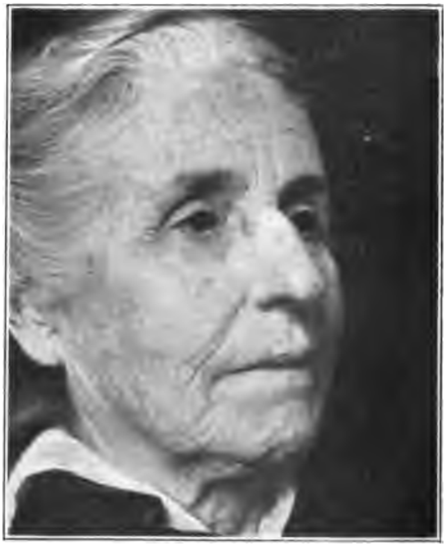

Fig. 79.—Case No. 7218. Same patient as in Fig. 78, well after four treatments.

gradually grew worse. He has had paste treatment and it is now bad. Examination shows a cauliflower epithelioma on the right ala and a flat epithelioma on the left side of the nose.

Results.—The epitheliomata have entirely disappeared, the skin being soft and pliable. (Figs. 80, 81, 82.)

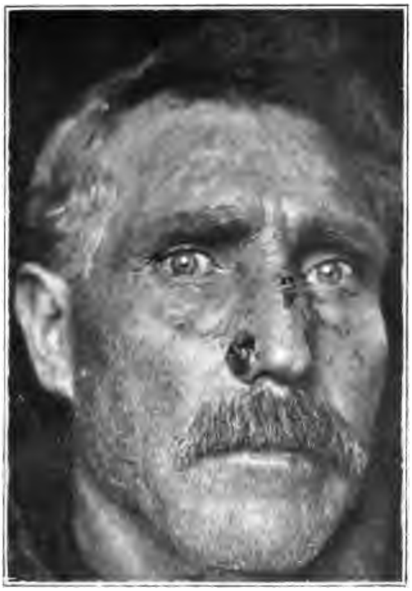

Fig. 80.—Case No. 7627. Large epitheliomata on the nose recurrent after removal by arsenic paste.

Case No. 7493

Mr. G. W. O., sixty-five years old. He has had a sore on the lobe of the right ear for five years and on the right side of the neck for one year.

Diagnosis.—Epithelioma.

Results.—He is entirely well after three treatments. (Figs. 83 and 84.)

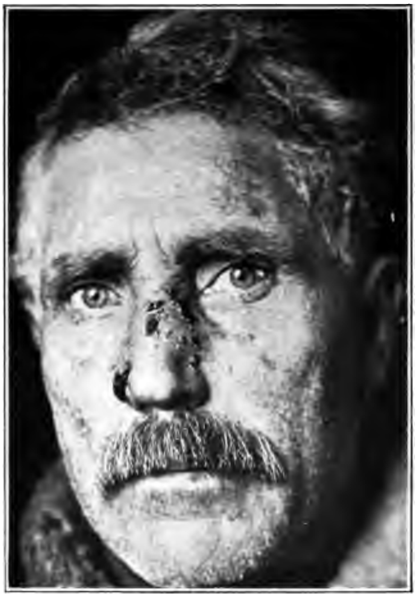

Fig. 81.—Case No. 7627. Large epitheliomata on the nose recurrent after removal by arsenic paste.

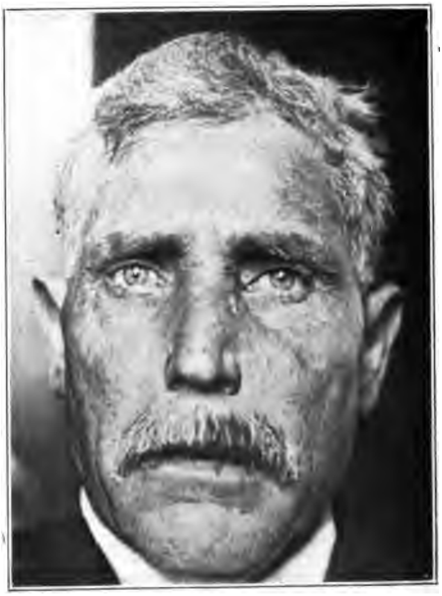

Fig. 82.—Case No. 7627. Same patient shown in Figs. 80 and 81 after treatment.

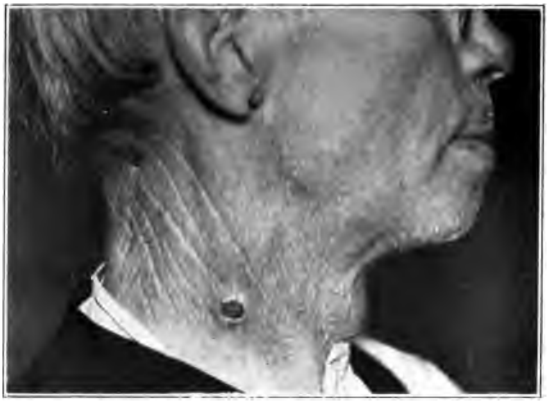

Fig. 83.—Case No. 7493. Epitheliomata of the lobe of the right ear and side of neck.

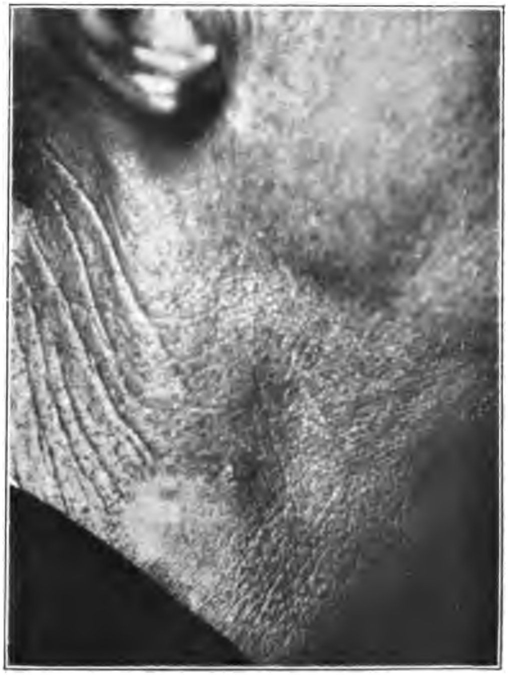

Fig. 84.—Case No. 7493. Same patient as shown in Fig. 83, after treatment.

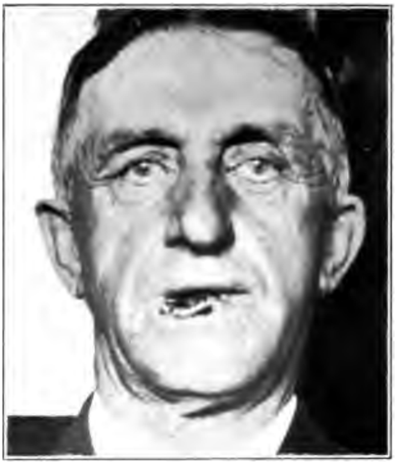

Fig. 85.—Case No. 2035. Large epithelioma of the lower lip recurrent after removal by arsenic paste and later removed by resection.

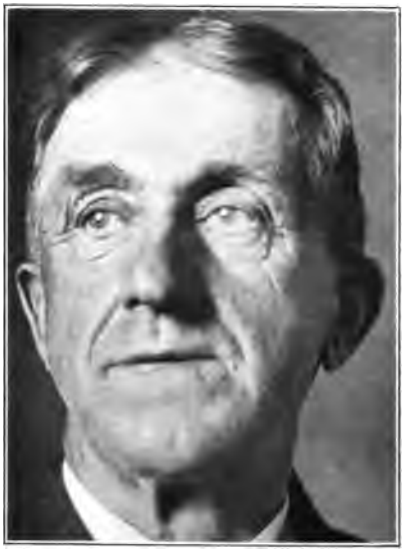

Fig. 86.—Case No. 2035. Same patient three and one-half years after roentgen therapy. Note the small amount of scar and the natural appearance and pliability ot the lip.

Case No. 2035

Mr. C. W. K., forty-two years old. For several years he has had a sore on the lower lip which would not heal. He had it removed with caustic paste two years ago but it returned. One year ago it was excised but returned. Now he has a large ulcerated mass the size of a twenty-five cent piece on the lower lip. No lymphatic involvement was found.

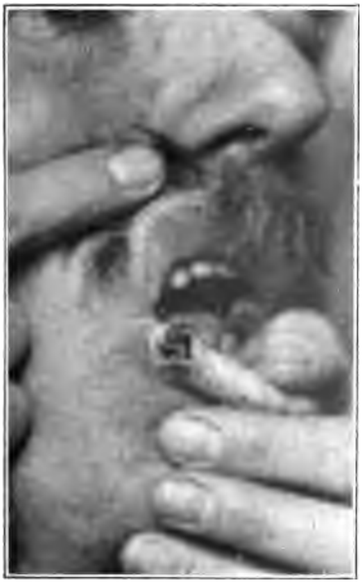

Fig. 87.

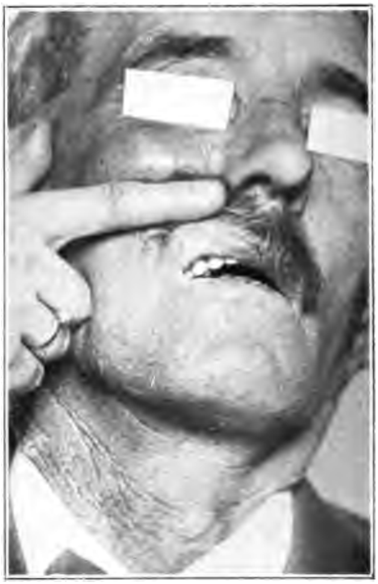

Fig. 88.

Fig. 87.—Case No. 7979. Large epithelioma on the right half of the lower lip before treatment.

Fig. 88.—Case No. 7979. Same patient as shown in Fig. 87 after two treatments.

Diagnosis.—Epithelioma of the basal-celled type.

Results.—He has had nineteen treatments covering a period of four months. The growth has entirely disappeared and has remained well two and one-half years.

The lip is as pliable as it was before the growth occurred. (Figs. 85 and 86.)

Case No. 7979

Mr. O. B. McB., fifty-six years old, married. For the past year and a half he has had a growth on the right half of the lower lip.

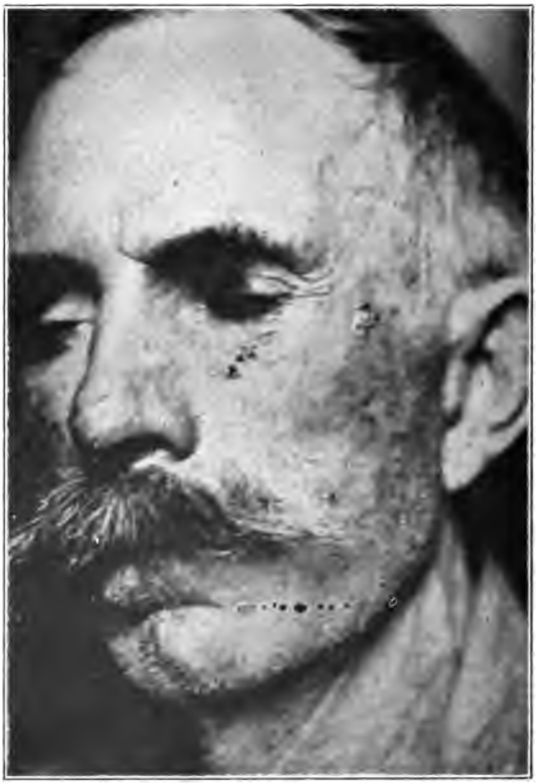

Fig. 89.—Case No. 7355. Multiple keratoses and small epitheliomata on the left side of the face, before treatment.

Examination.—Large hard papilloma probably undergoing malignant degeneration.

Results.—After electrothermic coagulation and deep therapy treatments, the growth entirely disappeared, leaving the lip soft and smooth. (Figs. 87 and 88.)

Case No. 7355

Mr. C. B., sixty years old, married. Three years ago he noticed a sore in front of the right ear. It never healed. Examination showed keratoses over the face and neck with a large ulcerating epithelioma in front of the right ear.

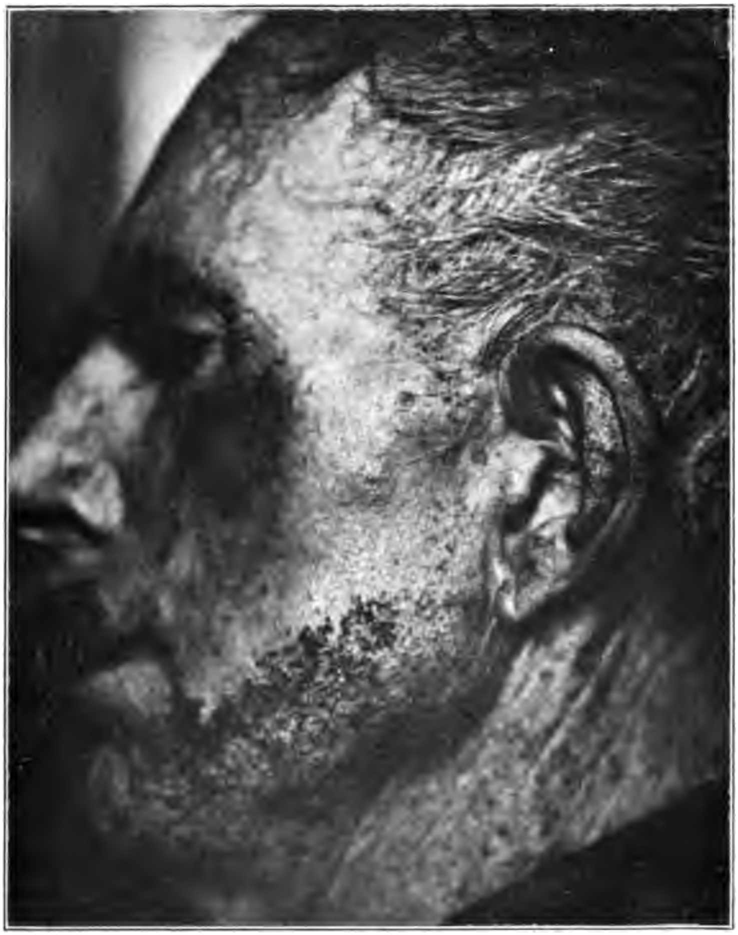

Fig. 90.—Case No. 7355. Same patient as in Fig. 89, after one treatment.

Results.—After one series of treatments, the epithelioma and keratoses had disappeared and he is still well. (Figs. 89, 90, 91 and 92.)

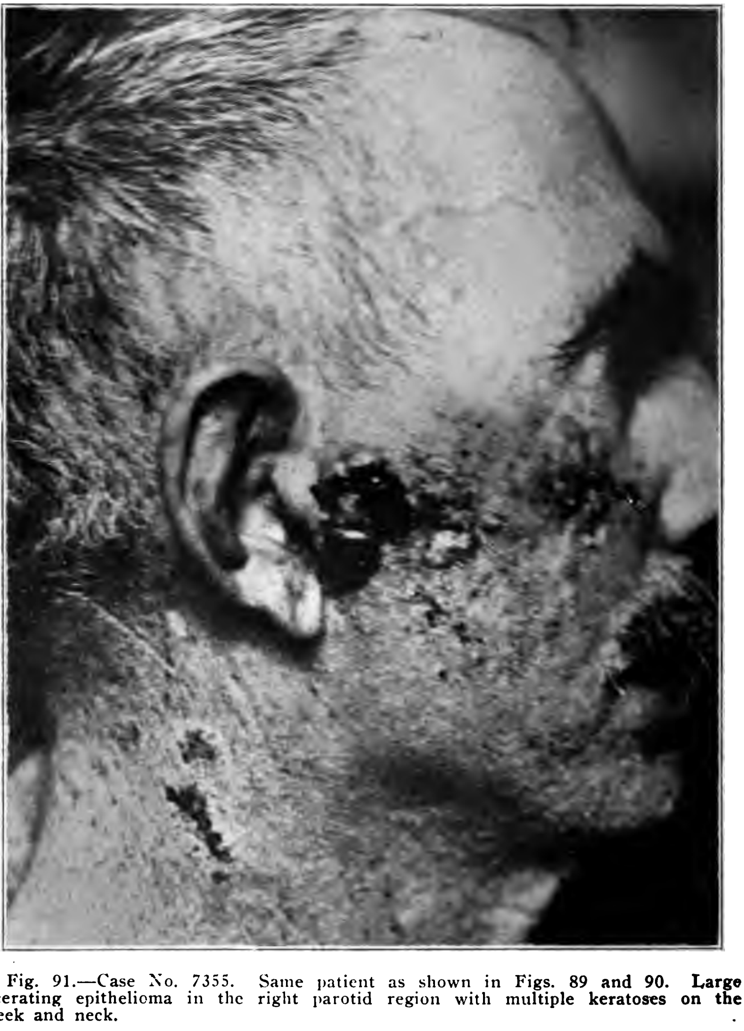

Fig. 91.—Case No. 7355. Same patient as shown in Figs. 89 and 90. **Large ulcerating epithelioma in the right parotid region with multiple keratoses on the cheek and neck.**

Case No. 7343

Mr. W. W., fifty-nine years old, married. **For ten years** he has noticed rough spots on both cheeks (keratoses). Four years ago he had a cancer burned out of the right cheek. September, 1917, he noticed lumps coming on the left side of the neck. November 14, 1917, he had a radical removal including part of the parotid gland. December 15, he had roentgen ray treatment.

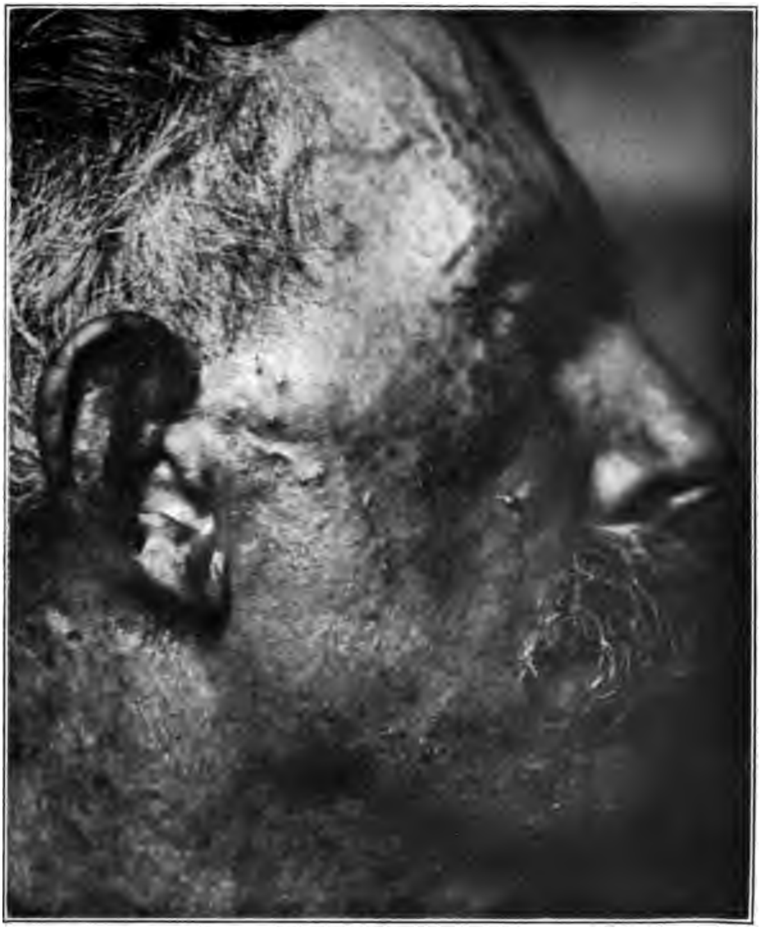

Fig. 92.—Case No. 7355. Same patient as shown in Fig. 91 after one treatment.

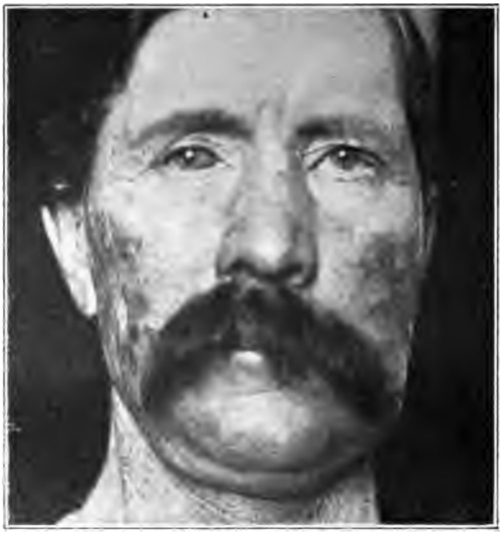

Fig. 93.—Case No. 7343. Multiple epitheliomata and keratoses on both cheeks.

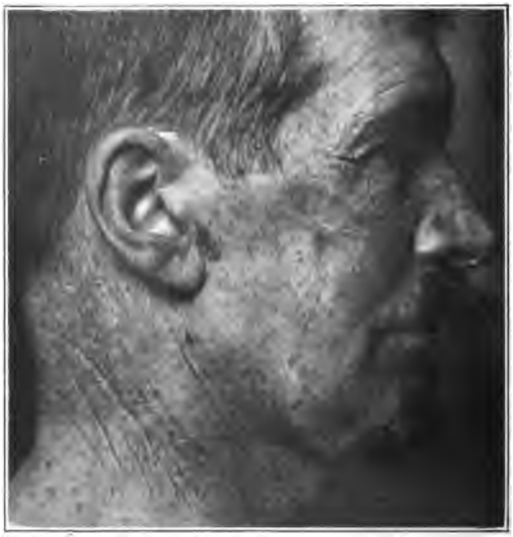

Fig. 94.—Case No. 7343. Same patient as in Fig. 93, after one treatment.

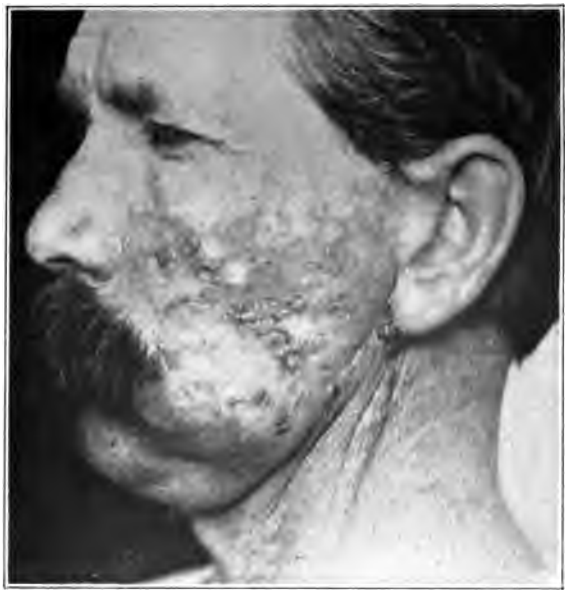

Fig. 95.—Case No. 7343. Left side of face of same patient shown in Figs. 93 and 94, showing multiple keratoses and the scar. Operated for resection of the left parotid and cervical glands because of carcinoma.

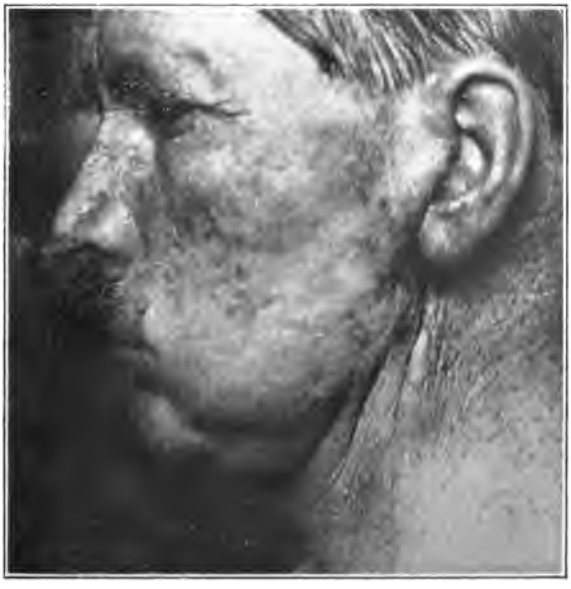

Fig. 96.—Case No. 7343. Same patient as in Fig. 95, after one treatment.

Results.—All keratoses disappeared after one treatment. The enlarged glands disappeared after two treatments. (Figs. 93, 94, 95, and 96.)

Case No. 7966

Mr. G. L., sixty-seven years old, married. December, 1917, he had trouble with his left lower molar teeth and had them pulled. Six weeks ago he had trouble with the lower front teeth and had them all pulled. Pus has been discharging from the left lower molar region since.

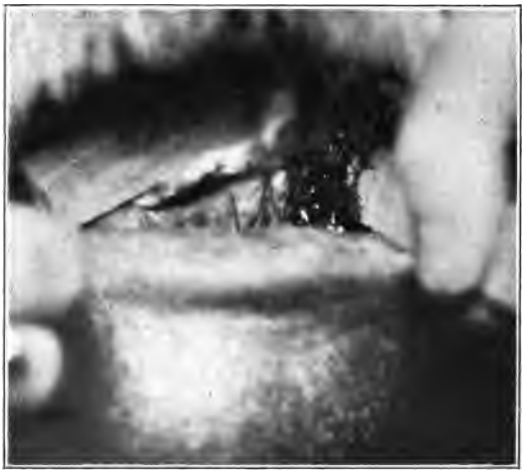

Fig. 97.—Case No. 7966. Large leukoplakia involving the inner side of the left cheek, the superior alveolar process and inferior alveolar process with cauliflower growth in the region of the left lower cuspid tooth. The leukoplakia entirely disappeared after one series of treatments leaving a healthy surface except at the site of the bone involvement where a sinus persisted.

Examination.—Large leukoplakia on the inner side of the left cheek, upper alveolus and palate and the entire lower alveolus. Large cauliflower mass in the lower molar and central regions.

Diagnosis.—Leukoplakia with cancerous degeneration.

Results.—After one series of deep therapy treatments the cauliflower mass and all visible evidence of the growth on the inside of the mouth disappeared, leaving only a clean sinus communicating with the left lower molar region. (Figs. 97 and 98.)

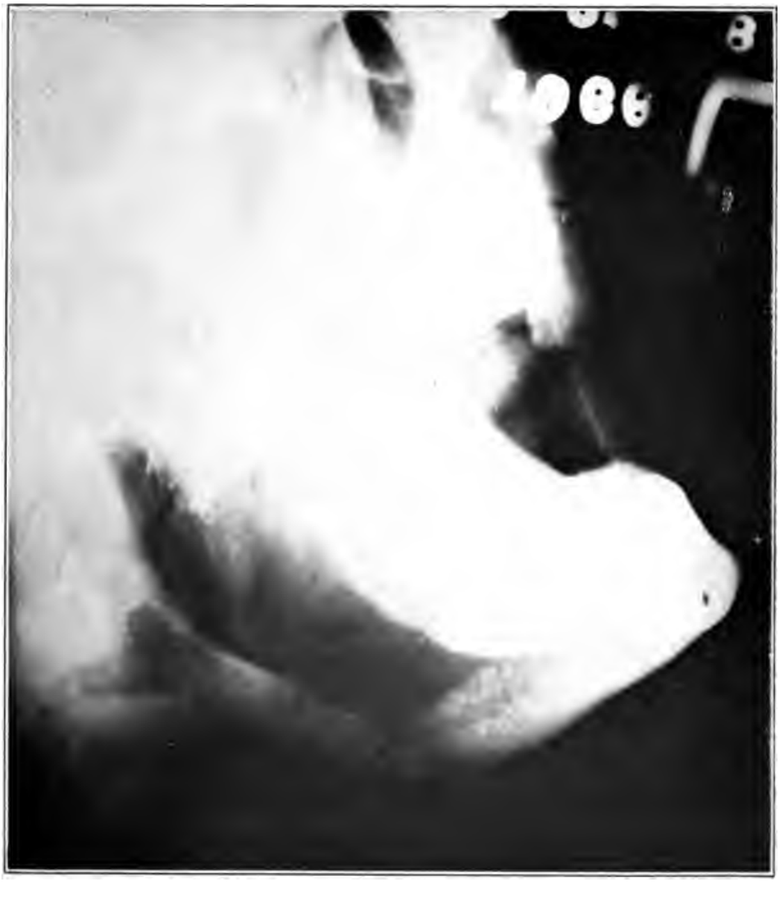

Fig. 98.—Case No. 7966. Roentgenogram of the left lower jaw of patient shown in Fig. 97. Note the bone destruction in the left lower molar region.

Case No. 6854

Mr. J. R., eighty-three years old. For the past five years has had a growth on the left temple which has gradually increased in size until it now involves the temple and the outer half of both eyelids and part of the cheek as shown in the photograph. It is ulcerating, bleeding and has a foul discharge.

Diagnosis.—Carcinoma.

Results.—After one series of deep roentgen treatments, the growth entirely disappeared and he has remained well one year. (Fig. 99.)

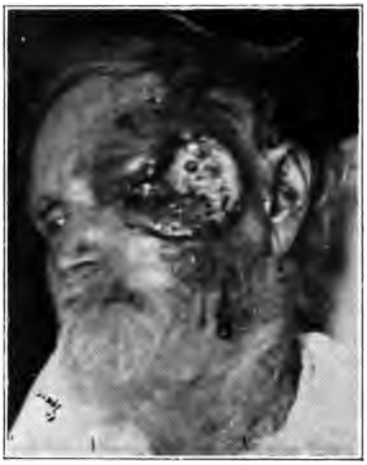

Fig. 99.—Case No. 6854 Large epithelioma of the left temporal region involving the eyelids and orbit. Patient eighty-three years old. Well after one series of treatments.

Case No. 7649

Mr. T. M., sixty-six years old, married. About one and a half years ago he had what he called a pimple on the right side of the nose. It grew rapidly. Five months ago he had arsenic paste applied. At that time it was the size of a walnut. He comes now with an ulcerating carcinoma covering the right half of the nose and the whole cheek with the eye completely closed.

Diagnosis.—Rodent ulcer.

Results.—He is now well after nine months. There is

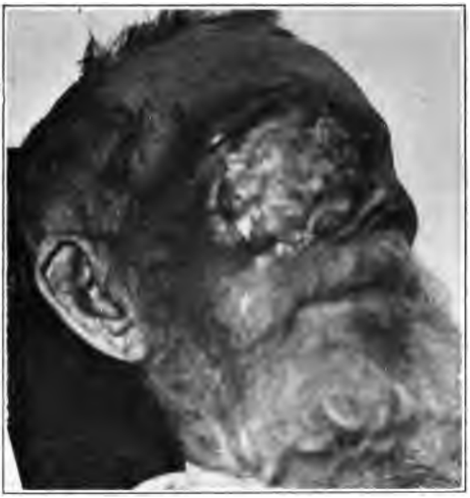

Fig. 100.—Case No. 7649. Large epithelioma springing from the right side of the nose involving the right cheek, eyelid, and orbit. This was a recurrence after removal of an epithelioma from the side of the nose by arsenic paste. Entirely well after one series of treatments.

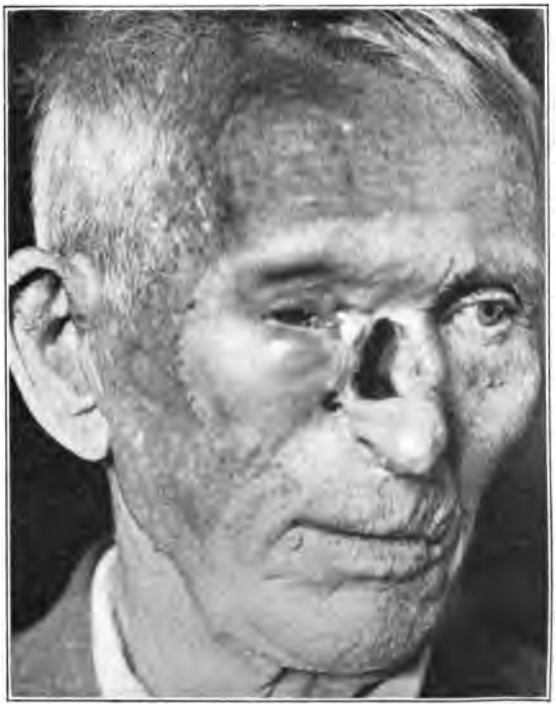

Fig. 101.—Case No. 7649. Photograph after treatment showing the entire surface covered over with new skin except the hole in the side of the nose which had been produced by the destructive action of the arsenic paste.

an opening into the right side of the nose as shown in the photograph. This is due to the arsenic paste treatment. Note the new skin covering the site of the growth. (Figs. 100 and 101.)

Case No. 2854

Mr. W. J., sixty-four years old, carpenter. Last February while working at his trade he struck the back of the left hand with a hammer. He knocked the skin off then and it never healed. It has constantly increased in size to date. It is not very painful. It had been treated with caustic paste.

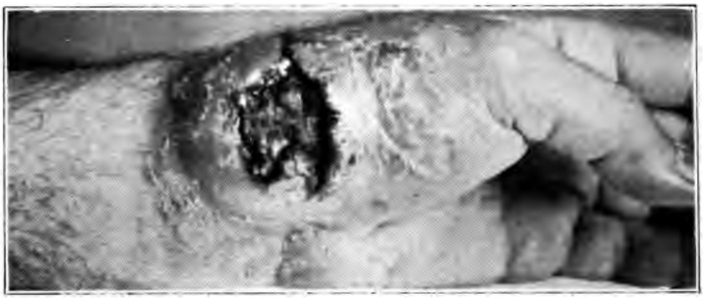

Fig. 102.—Case No. 2854. Carcinoma of the left hand. Recurrent after surgical removal. Very resistant to treatment.

Diagnosis.—Carcinoma.

Results.—This case was very resistant to treatment, the hard ridge around the margin failing to soften even under the most vigorous treatment. (Fig. 102.)

Case No. 4611

Mr. G. A. T., sixty-five years old. For several years he has had a sore on the lower lip. It was removed with paste. It was then operated by resection with removal of the glands on both sides. He now has a recurrence the size of an orange, ulcerating and foul.

Results.—We were able to stop his pain and prolong his life. The pain was so much diminished that he required little or no opiate. (Fig. 103.)

Case No. 6624

Mr. C. C. W., sixty-three years old. For the past two years he has had an ulcer on the lower lip. One year ago it began to grow very rapidly. It is now a large cauliflower growth two inches in diameter which hangs down on the chin, everting the lip.

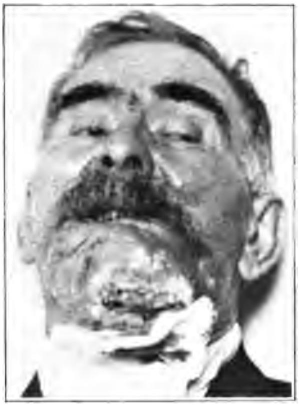

Fig. 103.—Case No. 4611. Extensive carcinoma of the chin involving the bone. A recurrence after epithelioma of the lower lip, removed twice by arsenic paste and once by resection and later by resection and removal of the submaxillary glands on both sides. This patient died but without pain, the pain ceasing after one series of deep roentgen treatments.

Diagnosis.—Ulcerating epithelioma.

Results.—The growth entirely disappeared leaving the lip soft and pliable. He is still well after two years.

Case No. 1925

Mr. E. B., forty-two years old, farmer. For one year he has had an ulcer on the lower lip which would not heal. It is now growing rapidly and bleeds when touched. There is no glandular involvement.

Diagnosis.—Epithelioma of the lower lip.

Results.—He has had only three treatments. The lip is soft and pliable and has remained healed more than three years.

Case No. 5414

Mr. J. L., seventy-six years old. About twenty years ago he had a white-looking place on the inner side of the left cheek and gum. It became hard like gristle. About six years ago it began to change, looking rough and red and got larger. There is not much pain, except when he presses or moves the mouth.

Diagnosis.—Carcinoma following leukoplakia.

Results.—He is well fifteen months after treatment.

Case No. 7676

Mr. H. McG., fifty-three years old. Three months ago the left lower jaw became sore from pressure of a jagged molar tooth. He had the lower teeth extracted. He noticed an ulcerated area on the mucosa back of the teeth and milk-white in appearance on the inner side of the cheek. He is a heavy smoker.

Diagnosis.—Leukoplakia involving the anterior pillar of the pharynx, tonsil and root of the tongue. There are no palpable glands.

Results.—After one series of treatments the growth has disappeared.

Case No. 7345

Mr. T. T. For three years he has noticed a whitish patch on the right alveolus. Later an ulcer developed which caused recession of the gums, then the growth became raised. Now, all of the right upper teeth are extracted from the right lateral back. There is a reddish ulcerated surface with destruction along the alveolus, milk-white along the margins.

Diagnosis.—Leukoplakia.

Results.—He has had two series of deep therapy treatments from the outside through the cheek and two through the open mouth, directly on the growth, with no filter. The growth has disappeared.

Case No. 7570

Mr. N. H. T., forty-six years old, married. About one year ago he noticed a milk-white appearance on the upper left alveolus under his false plate. It was painted with iodine by a dentist and improved. Later, he noticed a red elevated area in the same place.

Diagnosis.—Leukoplakia.

Results.—After two series of treatments the elevated cauliflower area has entirely disappeared and the mucosa has a normal appearance.

Case No. 3986

Mrs. J. C. H., fifty-two years old. In June, 1915, she noticed a thick place on the right side of the tongue well back. She had her teeth fixed. She then went to a doctor who diagnosed the trouble as syphilitic. She did not respond to treatment. Later a Wassermann was made which was negative. She comes now with a large ulcer of the right side of the tongue well back. The whole right half of the tongue is indurated. All the glands on the right side of the neck are very much indurated.

Diagnosis.—Inoperable carcinoma.

Results.—The growth progressed rapidly in spite of

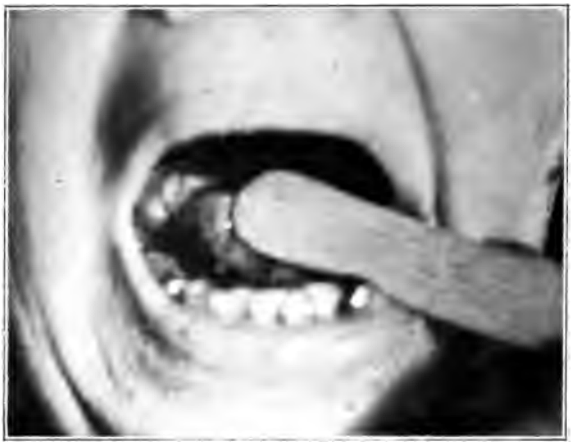

Fig. 104.—Case No. 3986. Carcinoma involving the right half of the tongue with extensive metastasis in the lymphatic glands in the right side of the neck.

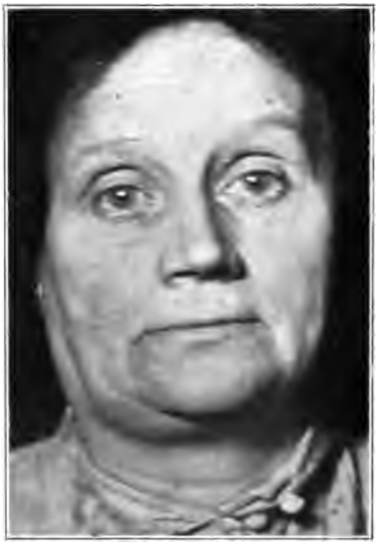

Fig. 105.—Case No. 3986. Showing the enlarged glands in the side of the neck in the same patient as in Fig. 104. The pain was relieved and her life prolonged for several months by deep roentgen therapy.

treatment, resulting fatally in a few months. This patient was too far advanced when first seen by the author to promise more than relief from the pain. (Figs. 104 and 105.)

Case No. 6545

Mrs. E. F. S., Four years ago she had a lump removed from the left breast. The microscope showed it to be carcinoma. The breast was amputated. Later, enlarged glands appeared above the clavicle. These were removed. She now has large cervical glands on both sides extending from the ears to the sternum.

Results.—She is now well nine months after treatment.

Case No. 6625

Mrs. H. E. N., forty-eight years old. In November, 1915, she began to have pain in the right part of the abdomen. After the pain disappeared she was troubled with constipation. This continued until July 13 when she was operated. She was said to have cancer of the bowel which was grown to the blood vessel and could not be removed. They made a short circuit to relieve obstruction.

Diagnosis.—Inoperable carcinoma in the right iliac region.

Results.—One and one-half years after treatment she is feeling fine and has normal weight.

Case No. 6149

Mrs. P. S., thirty-six years old. Two years previous she had an ovarian cyst removed. One year ago she had a cyst of the other ovary removed. Four months ago she had a curettement and has continued flowing since. Examination showed a small uterus rather hard.

Diagnosis.—Metrorrhagia.

Results.—After one series of deep treatments, all bleeding stopped and it has not recurred in nine months.

Case No. 6622

Mrs. W. O. T., thirty-eight years old, married, 5 children. Eleven years ago she had repair and fixation. Seven years ago she had an operation on the right kidney and uterine suspension. One baby has come since each operation. Both births were normal. October 21, 1916, she began to flow and has flowed constantly since. She has had no miscarriages. She has had two curettements with no relief. No fibroid is present.

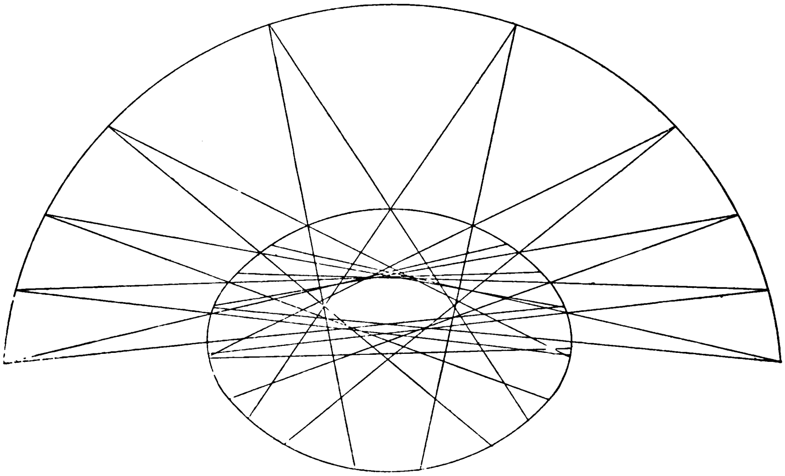

Fig. 106.—Schematic illustration showing working plan for giving deep roentgen treatment in tumors located within the body. The skin is marked off into many areas, the rays being focused through each skin area at the tumor. By this method it is possible to get a sufficient dosage into the tumor without injury to the skin.

Diagnosis.—Climacteric hemorrhage.

Results.—She has had only one series of deep therapy treatments. The hemorrhage ceased entirely and has not recurred. She has been well more than one year.

Case No. 7011

Mrs. E. N., forty-five years old. For several years she has had a fibroid tumor of the uterus. She has had local treatment. At one time she was jaundiced. She has been flowing several months and is very anemic.

Diagnosis.—Uterine fibroid the size of a lemon.

Results.—After two series of deep treatments all bleeding stopped and has not recurred in four months. The tumor is not palpable.

Case No. 6563

Mrs. H. C. L., forty-eight years old, married. She has had both breasts removed for carcinoma by arsenic paste. She has diabetes and gall bladder inflammation. She has marked menorrhagia and a fibroid the size of a pear.

Diagnosis.—Uterine fibroid—subserous on the right side of the uterus.

Results.—After three series of deep treatments, all hemorrhage has stopped and has not recurred at five months. The tumor is much reduced in size.

Case No. 6620

Mrs. A. H., thirty-six years old, 7 children. Four months before the last baby was born she had to stay in bed. When the baby was seven months old, she began to menstruate. She has been regular but flows excessively, using six to eight towels a day during the period. She must go to bed each time. She expects period in one week. Examination showed a uterine fibroid intramural type.

Results.—She has had only two series of deep treatments. One menstrual period came, after which the hemorrhage ceased and has not recurred in two years.

Case No. 6626

Mrs. F. H., forty-four years old. She weighs 90 pounds. Four years ago she noticed a lump in the right breast. July, 1915, she consulted a doctor who found trouble in both breasts. In 1915 she saw the Mayos who found cancer of the uterus, liver, and both breasts. She was referred for roentgen therapy, coming December 13, 1915.

Results.—She has had eighty-seven treatments, comprising fourteen series, covering the entire torso from the chin to the pubes—front, back and both sides. When she came she was bedfast and unable to eat or sleep because of the pain. Her pain disappeared, the uterine hemorrhage ceased, she gained weight, was able to sleep and eat anything she liked. She has been doing her own housework for more than one year. Both breasts are soft and the liver is barely palpable, while the uterus is still boggy.

Case No. 7010

Mrs. E. A. R., thirty-five years old, married, 6 children. Thirteen months ago she had a hysterectomy for cancer of the uterus. She now has a recurrence in the vault of the vagina. She is bleeding badly and is very weak and anemic.

Results.—One week after the first series of deep therapy treatments, the hemorrhage and pain ceased and has not recurred. The anemia has disappeared, she has gained weight and feels fine.

Case No. 8064

Mrs. H. A. S., fifty-four years old. Four years ago she had the right breast removed with arsenic paste. Last fall she noticed a return. She has had roentgen

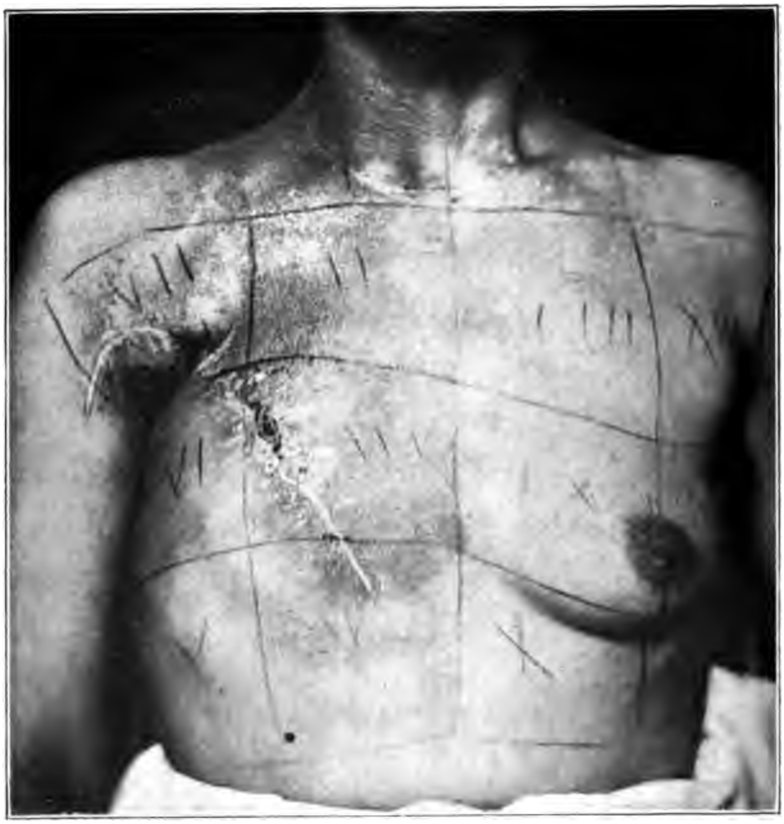

Fig. 107.—Photograph showing method of marking off the skin areas for post-operative roentgen treatment following surgical removal of the breast for carcinoma. Not only is the affected side treated but the nonaffected side also.

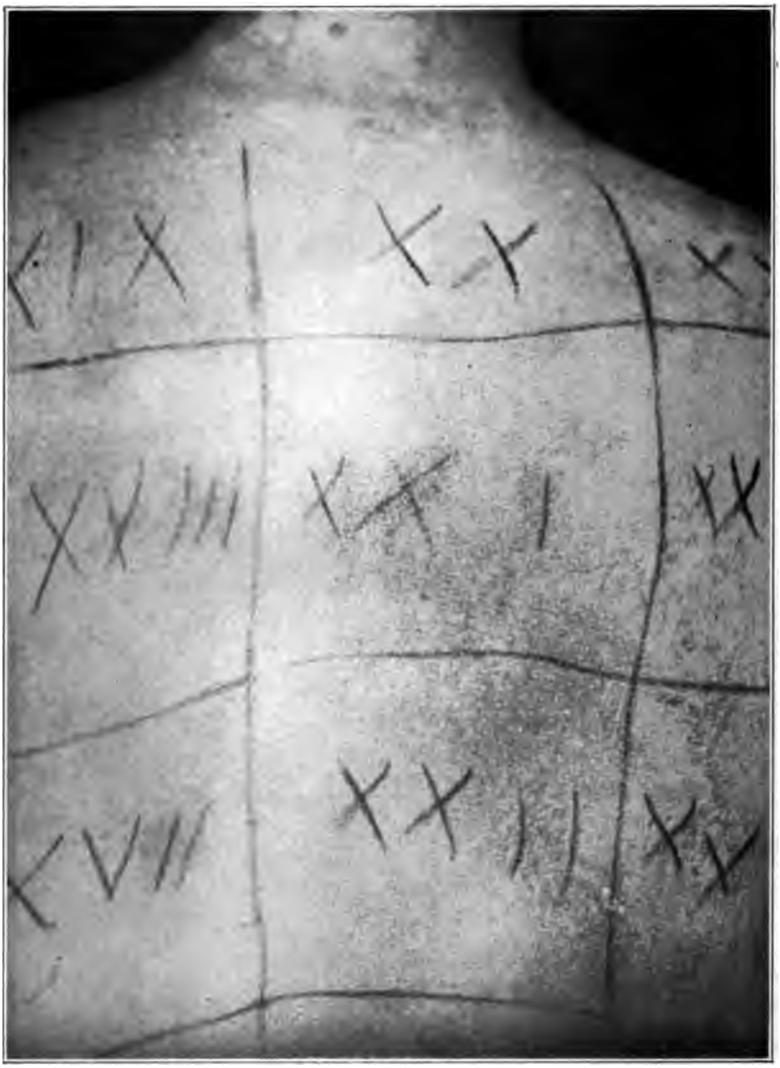

Fig. 108.—Photograph showing method of marking off the back for deep roentgen treatment in patients who have had the breast removed surgically for carcinoma. The entire chest is treated, front, back and sides from the waist line up to the mastoid processes.

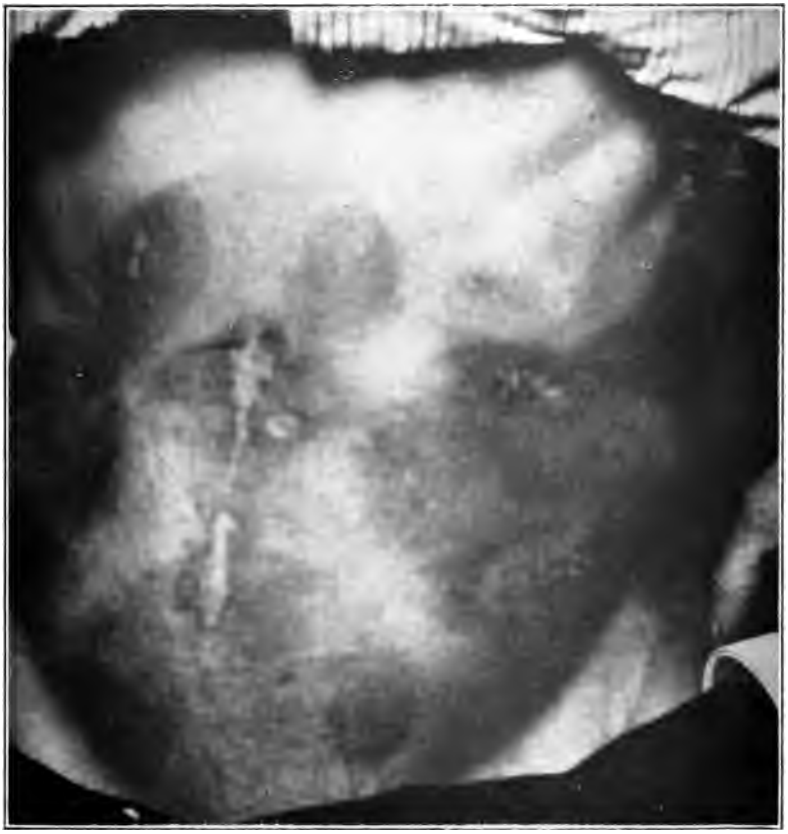

Fig. 109.—Photograph showing the wrong way of giving deep roentgen treatment. Note the irregular patches of tanned skin with healthy skin intervening.

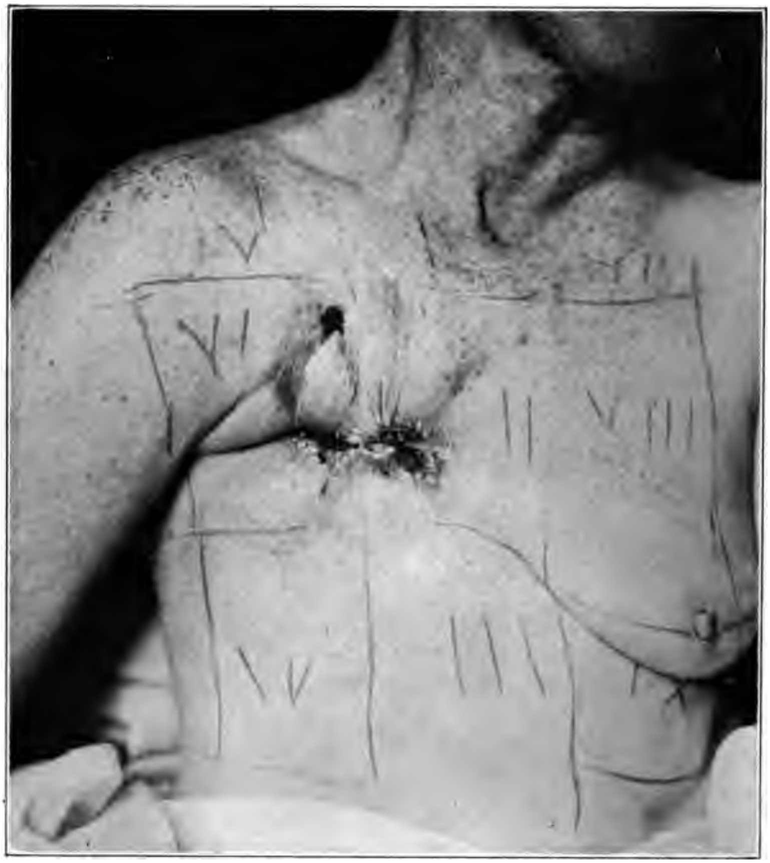

Fig. 110.—Case No. 8064. Photograph of patient who had the right breast removed by arsenic paste for carcinoma. Recurrence with marked induration, the entire mass being attached to the chest wall and immovable. The pleura is also involved in the recurrence. Marked improvement after deep roentgen therapy.

ray treatment once a month from another doctor, beginning October, 1917.

Examination.—No erythema. A very extensive hard mass covering an area the size of the palm of both hands with many small areas throughout the skin of the right chest. (Fig. 110.)

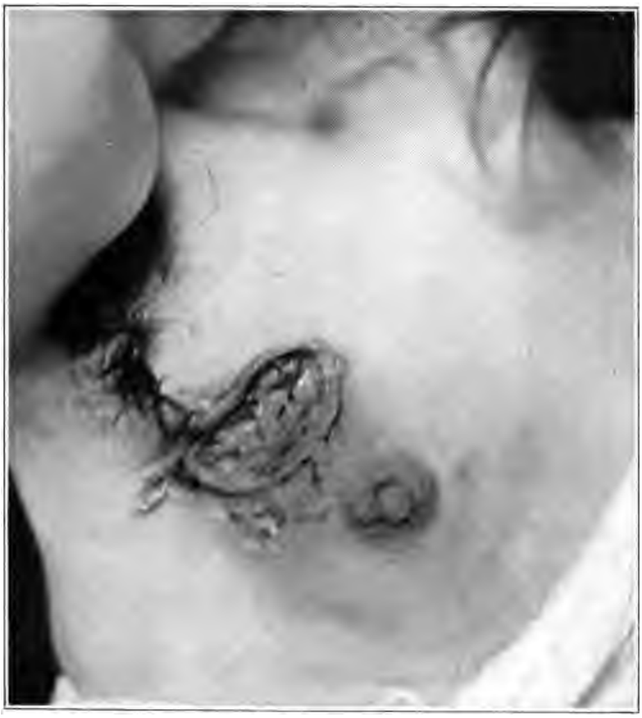

Fig. 111.—Case No. 8472. Inoperable carcinoma of the right breast. The breast was fixed to the chest wall and there was marked enlargement of the axillary and supraclavicular glands. Entirely well after three series of deep roentgen treatments.

Case No. 8472

Mrs. L. A. H., forty-seven years old, married, the mother of three children. About eighteen months ago she noticed a lump in the upper, outer quadrant of the right breast. This slowly enlarged. Four months ago she fell across the back of a chair, bruising the lump, and shortly afterward an open sore appeared at the side of the bruise. This has failed to heal under ordinary treatment. Now the entire breast is hard and fixed to the chest and there are large glands in the right axilla and above the right clavicle. The condition has been pronounced inoperable by many surgeons. Roentgen examination shows the parietal pleura involved.

Results.—After three series of roentgen treatments the entire breast has become soft and normal in appearance, the ulcer has healed and the glands have disappeared from the neck and the axilla.

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